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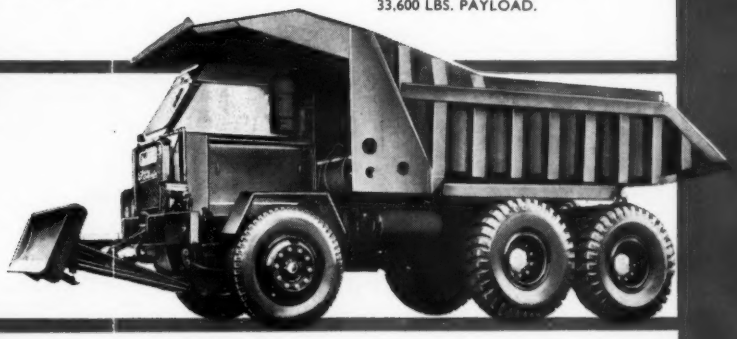

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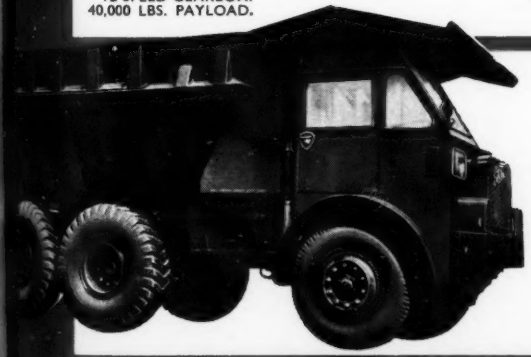

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The Mining Journal

London, May 29, 1959

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Echo from a Symposium

NON-FERROUS metal mining in the United Kingdom has by any standards had a distinguished past and, moreover, one from which was derived both the personnel and the *expertise* which created Britain's overseas mining industry. So much is history. Today the question is whether non-ferrous mining in Britain has got a future.

It was to find the answer to this question that the Symposium on the Future of Non-Ferrous Mining in Great Britain and Ireland was sponsored last autumn by the United Kingdom Metal Mining Association and the Institution of Mining and Metallurgy, at which some 20 papers were presented examining what was already known or could be inferred about Britain's non-ferrous mineral resources and about the fiscal and market climate necessary to render them economic. Subsequently, Dr. K. C. Dunham was invited by U.K.M.M.A. to prepare a report based on the papers and discussion at the Symposium. This report has now been completed and copies have been sent to the President of the Board of Trade and to the Lord President of the Council.

Dr. Dunham's terms of reference were to assess the potentialities of Great Britain as a source of non-ferrous metallic ores with reference both to the location and nature of the deposit and, where possible, its probable extent and grade. These potentialities were to be presented in three categories—(a) those ready for immediate development or exploration, whether in active production, in suspense or in embryo; (b) those requiring further exploratory work before their full economic potential could be assessed and finally (c) those deposits the actual extent of which could at present only be inferred from existing geological evidence. Beyond this, Dr. Dunham's terms of reference were concerned exclusively with the last of these categories, in respect of which he was asked to advise (i) on the practical steps necessary to prove the deposits (ii) on whether the government could reasonably be asked to undertake any of this work and, if so, which part, and (iii) to make an assessment of the probable cost.

It would seem from Dr. Dunham's terms of reference that the U.K.M.M.A. has accepted the view, which was widely inferred at the Symposium, that it would be unrealistic in existing circumstances to expect the Chancellor of the Exchequer to grant special tax concessions to a domestic industry which, within the memory of civil servants now in Whitehall, has had little national economic significance except in times of war, and which, if given preferential treatment, might create an embarrassing precedent in respect of other and larger extractive industries.

Instead, the Association has concentrated its attention on the problem of ways and means of promoting a more complete audit of Britain's mineral resources. This is in accord with our impressions immediately after the Symposium when we wrote (*The Mining Journal*, September 26, 1958) "to those who feel that a flourishing British metal mining industry should today be a high national priority, we would suggest that the immediate point of attack should be to encourage financing of further prospecting and drilling at depth. Certainly, the most that can reasonably be asked

of the government at this stage is to allow tax relief on all such expenditure and beyond this to urge that some semblance of order should be introduced into the confusion arising from the private ownership of mineral rights".

It follows that, although Dr. Dunham lists in detail the areas of proved and probable ore reserves in categories (a) and (b), the main interest of his report lies in the evidence he marshals from the Symposium papers and discussions regarding the most promising areas for further exploration on the basis of existing geological evidence. He lists nine such area:—(1) St. Just/Pendeen area of Cornwall; (2) Marazion, Godolphin Hill and Scorrier areas, Cornwall; (3) Highoredish, south of Ashover, Derbyshire; (4) Great Hucklow Rake, North Derbyshire; (5) Horeshoe Anticline, Flintshire; (6) Pikestone area, N.E. of Middleton-in-Teesdale, Co. Durham; (7) North Rookhope area, Co. Durham; (8) Rotherhope area, East Cumberland; (9) South Daren area, Cardigan.

He believes that each of these areas offers the possibility of discovering workable non-ferrous deposits on a scale sufficient to yield annually 500 tons of tin metal in the case of areas 1 and 2; and 5,000 tons of lead or zinc metal in each of the remaining areas. He considers it within the bounds of possibility that further exploration of these areas might lead to the identification of reserves capable of yielding an annual production worth £5,000,000 at present prices. This, of course, would be in addition to whatever production could be expected from deposits in categories (a) and (b).

Dr. Dunham's report then goes on to indicate the work which he considers needs to be done to confirm the existence of the inferred deposits in his nine selected areas. This includes in a few cases detailed large-scale geological mapping in conjunction with air photography, geophysical surveying, both of land and the off-shore areas of Cornwall, and geochemical surveying in a number of areas. Exploratory drilling, however, he regards as the chief requirement and in a total exploration budget of £300,000 he has made a provision of £200,000 for a total of 60,000 ft. of boring.

He suggests that government aid might reasonably be sought for this preliminary programme and that it could be made available either through the Geological Survey (for which additional staff and funds would need to be made available) or by reconstituting the government-owned company, which existed during World War II under the title of Non-Ferrous Metals Development, Ltd. Where preliminary exploration was successful, it would then be reasonable, he feels, to expect that the further exploratory work leading up to development of the property would prove attractive to private enterprise, although he puts the cost of underground exploration at not less than £100,000 for any single project, together with a further £250,000 for subsequent development. In saying this he is presumably assuming existing fiscal and market conditions, although he does hint at the idea of a guaranteed floor price for domestic producers, but this can scarcely be seriously intended!

From a national point of view there is a good case to be made out for the government guaranteeing the small budget suggested in Dr. Dunham's report since, whether or not Britain's non-ferrous mineral resources are worthy of intensive exploitation today, there can be no argument that in the long run rising rates of world mineral consumption and rising prices will eventually induce a revival of British non-ferrous mining with or without tax concessions. A mine, once it is in operation, becomes a wasting asset but undeveloped mineral resources seem certain to continue to appreciate in value at an accelerating rate.

There is thus everything to be said for an audit of these reserves so long as it is realized that the time for their actual exploitation is not yet and, indeed, may not be, ripe for a good many years to come. Whether it is in any degree realistic to expect a British government, which has yet to appreciate the greater urgency of formulating a Commonwealth mineral resources policy, to apply itself to the lesser problem now posed by U.K.M.M.A. is, however, quite another matter.

THE POLITICAL FACTOR IN KAFFIRS

The Anglo American Corporation had a notably successful year in 1958 despite the difficulties of the diamond and copper markets—both of which are now in better fettle than a year ago. It is apparent from the Corporation's report and accounts reviewed elsewhere in this issue (page 597) that the notable improvement both in earnings and in asset values is very largely a reflection of the mounting stream of gold from the new South African mines started up since World War II and which only within the last two or three years or so have really "come on stream".

For those seeking a hedge against depreciating currencies, South African gold shares are both on financial and on technical mining considerations the obvious refuge and much to be preferred to the gold bar, which cannot itself go up in value but can only play the passive role of waiting for currencies to depreciate.

If at first sight it is something of a novelty to find the hot money coming from North America rather than Europe, in fact the past devaluations of sterling and other currencies have probably helped as much as anything to place the skids under the dollar and although Washington still steadfastly refuses to take off the brake, the law of gravity must eventually assert itself in economics as in nature.

The dilemma which must undoubtedly be facing many a would-be American purchaser of South African gold shares is, on the one hand, his desire to hedge into gold and, on the other, his great remoteness from South African affairs coupled with a suspicion that the present political régime may fail to devise a workable long-term pattern for multi-racial co-existence. Similar fears have, of course, been entertained by British and Continental investors in the last decade but over here, much more than in the U.S., the investor has come to distinguish between legislative intent and executive action in the face of economic and demographic reality.

It follows that what Mr. Harry Oppenheimer has to say in his annual statement to Anglo American shareholders this week on the subject of political developments in Southern Africa will be of particular interest on the other side of the Atlantic. In his statement (reported in full on page 598) he underlines two points about the Union which can only fully be appreciated from on-the-spot observation. The first is the remarkably rapid rise in the material well-being of all races in the Union in the past 15 years. Relatively, the standard of living of the African has actually been rising more rapidly than that of the European, although the former remains, of course, far too low. Social progress is, indeed, occurring, even in the Union. The real issue is whether the rate of progress is rapid enough.

In this context, Mr. Oppenheimer makes a second most significant point when he emphasizes the noticeable change in thinking of a large cross-section of Europeans in the Union during the past year. "Most Europeans in South Africa", he says, "now realize that, in due course, the Africans must obtain a share of the government of the country. The differences between parties do not turn on

whether or not Africans should have greater civic rights but on whether reasonable African aspirations can, or should, be satisfied by the grant of autonomy in their tribal areas or whether, on the other hand, they must receive a share in the central government of a united country". Mr. Oppenheimer's conclusion is that they must have both. "The development of local self-government for Africans in the tribal areas, and the granting to Africans of a part in the central government, are not opposed but complementary conceptions".

This is not the first indication that we have had that the thinking of informed public opinion in the Union is beginning to get ahead of government thinking. If this is happening on a wide front, there is yet hope that the government may pluck up courage to educate and lead the thinking of the large rank and file of its less politically mature supporters.

Meanwhile, many American investors will, no doubt, remain apprehensive of the political risks of investment in South Africa, but it is an interesting speculation whether, at the present juncture, this is necessarily a bad thing for the Kaffir market. Mr. C. C. Wiley, past-president of the Johannesburg Stock Exchange, was reported earlier this week as saying on his return from the U.S. that there would be no knowing what would happen to prices if one of the big U.S. broking firms really got interested in Kaffir shares. This comment does no more than re-emphasize what we have been suggesting in these columns for some time past—namely, that the weight of risk capital in the U.S. is such that the Kaffir market could easily get swamped if large-scale switching by American investors were suddenly to develop.

Another artificial inflation of Kaffir share values would do far greater harm to confidence in this market than could any amount of misguided legislation in the Union. Indeed, although institutional and professional buying of gold shares, and more particularly of investment companies holding gold portfolios, has been reviving in Britain over the past year or so, it is doubtful whether the ordinary investor has yet recovered from the disappointments of 1949 and 1953.

In any case, there are more ways of hedging into gold than by buying Kaffirs. Private purchases of gold by dollar holders have been notably on the increase and if this goes on for long enough, *de facto* devaluation of the dollar is bound to follow—not perhaps by any formal announcement but simply by a refusal of the Federal Reserve Bank to continue to sell gold. This would put the dollar where it belongs in the money markets of the world as quickly as anything else and might well lead to some readjustment of sterling, which would in turn bring direct benefit to South Africa's gold mines.

JAPANESE INTEREST IN ISRAELI MINERALS

Timna Copper Works, in the south of Israel, has now reached an output of 85 per cent of the planned capacity, and production is proceeding smoothly. According to Mr. E. Bodenkin, director of Israel Mining Industries, it can be expected that full production of about 10,000 tons of copper cement a year will be achieved in the near future. The metal content of the cement has proved to be higher than expected, i.e., 74 per cent instead of 65-70 per cent as previously thought. The plant is at present employing 260 people, all living in Eilat.

Geologists of Israel Mining Industries Ltd. have verified additional layers of copper ore totalling some 20,000,000 tons in the vicinity of Timna, near the plant, and they have also expressed the belief that there are another 20,000,000 tons in the area.

During his recent visit to Israel, the president of the Japanese Export-Import Bank expressed readiness to commit his bank to participate in the expansion of the Timna Copper Works. It is learned that a scheme is under consideration to repay the projected investment (reported to be between $2,000,000 and $3,000,000) through future Israel exports to Japan. The visit a few weeks ago to Israel of a group of Japanese financial leaders has also been leading to a number of other Japanese investments in Israeli industrial enterprises, and to a planned export to Japan of 60,000 tons of phosphates during the current year.

Israeli exports to Japan in 1959 will include some 60,000 tons of phosphates. Later on, Japan may buy from Israel up to 100,000 tons of rock phosphates per year. Israel in time may buy increasingly more machinery and industrial equipment in Japan. (See note on page 594.)

EUROPEAN COAL STOCKS STILL RISING

The Pool coal glut crisis worsened during last month, according to statistics published recently by the High Authority, governing body of the six-nation European Coal and Steel Community. The Community's overall stockpile went up from 28,000,000 tons at the end of March to 30,292,000 tons on April 30, the statistics said.

The situation was most critical in West Germany where stocks increased by roughly 1,000,000 tons over the month reaching 10,910,000 tons by the end of April. In France they rose from 8,763,000 tons to 9,640,000 tons, in the Saar from 1,089,000 tons to 1,195,000 tons, in the Netherlands from 841,000 tons to 933,000 tons, and in Italy from 45,000 tons to 68,000 tons.

The High Authority's plan to try to solve the surplus crisis and its accompanying unemployment by "supranational" measures was rejected by the Community's Ministerial Council meeting in Strasbourg last Thursday. The rejection of the plan, which provided for import and production quotas, was due to opposition from West Germany and France.

In Britain, stocks of coal have now climbed to almost 38,000,000 tons, of which rather more than 24,000,000 tons are undistributed, i.e., unsold stocks held by the National Coal Board.

SHIPPING IRON ORE AT WHITE HEAT

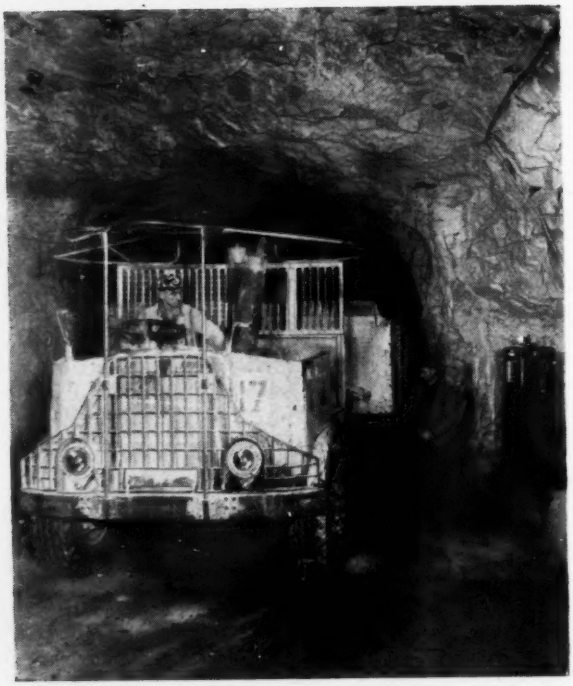
An interesting new type of ship has been developed in the Soviet Union for carrying iron ore at a temperature of 1,250 deg. F. between the Black Sea ports of Kerch and Zhdanov. The first of these ships, the *Mga*, has been in service for some time already, presumably with satisfactory results, since others will soon be joining her on this run.

Some difficulty was experienced, according to the chief designer of the *Mga*, in producing a ship which would stand up to the very high temperature involved, and would provide tolerable working and living conditions for the crew. What was done was to convert an ordinary ore lighter to having sliding sides, so that loading and unloading could be fully mechanized. Thus, in operation, the white hot ore is conveyed by grabs direct from the ship to the Kamysh-Burun iron and steel works.

The sides and bottom are built in sections, between which there are temperature gaps, so that they expand quite freely. Insulating material poured between the walls and the main hull prevent deformation of the latter. A powerful ventilating system, with special filters, supplies cool, clean air to spaces occupied by the crew.

Mining Anhydrit

By



THE Billingham works of Imperial Chemical Industries Ltd. is the largest chemical factory in the British Commonwealth. Five I.C.I. Divisions—Billingham, Heavy Organic Chemicals, General Chemicals, Plastics and Dyestuffs—occupy the 1,100 acre site. The factory makes 90 different products, including fertilizers, acids, building products, a wide range of organic chemicals, sodium, chlorine, cyanides, plastics and nylon polymer. The total output approaches 2,500,000 tons a year. Anhydrite is mined below the factory site.

The mineral mined at Billingham has the brief description name of anhydrite, more fully described as anhydrous calcium sulphate, with the chemical symbol $CaSO_4$. As mined it is found as a hard, white rock, like limestone, in a seam varying in thickness from 13 to 18 ft., and at inclinations from flat to 1 in 4. Anhydrite is used at Billingham as a source of sulphur in processes manufacturing sulphate of ammonia and sulphuric acid.

Billingham had to solve a number of problems in meeting the expanding demand for anhydrite. The most imperative was to devise methods of obtaining the mineral efficiently from working faces at ever-increasing distances from the two-compartment shaft without absorbing too many men on the unproductive work of underground transport.

Until recent years there has been no demand in this country for the heavy mining equipment used in a modern stone mine and in 1947 the first three half-track stone haulage trucks were delivered to the Billingham mine from the United States. They were followed by a Joy stone loader as the nucleus of a capital expenditure sanctioned by the company of the order of £750,000 to modernize the whole system of mining at Billingham.

The mine had operated from 1928 very much on coal mining practice, with 25-cwt. capacity tubs running on 30 in. gauge tracks, though as the system included 75 h.p. electric trolley locomotives, it was as advanced as any

Underground mining operations at Billingham. On this page, top left, is roof scaling, while immediately below at centre left, a truck is being refuelled with diesel oil at the mine fuel pump. Alongside, at bottom left, the prototype rig for electric rotary drilling is shown. The photograph at top right of the opposite page is of a Joy loader face loading on to a lorry, while at the bottom of the opposite page, a Joy loader and bulldozer are shown at work. This photograph in particular reveals the large driveways of the Billingham mine

By Trackless Methods

On Wednesday last week representatives of the Press visited the anhydrite mine of Imperial Chemical Industries Ltd. at Billingham, Co. Durham. Although the mine shaft was sunk in 1927, so that the property and its equipment have been discussed previously in *The Mining Journal*, the completion of a modernization programme, begun twelve years ago, lends immense interest to this underground operation. This is particularly the case when it is recalled that the orebody at Billingham is exploited solely by trackless mining methods.

mine in the country. Thus, the first trackless mining equipment had to operate where there were no made-up roads. The first half-track trucks, fitted with bulldozer blades, had, in fact, to make roads for themselves, fanning out from the mine shafts to the working faces. Indeed, twelve years of modernizing have given a complete "face-lift" to the mine which now has over 3,000 h.p. of diesel vehicles of various kinds. The Joy Loaders load stone into 14-ton capacity A.E.C. diesel trucks at a rate of 700 tons and more each shift.

While the majority of drilling duty in the mine is accomplished by compressed air percussive drills, the use of electric rotary drilling is being expanded. A prototype jumbo is in use. This electric rotary driller uses tungsten carbide bits for producing so coarse a grade of chips that most of the drill spoil being removed by auger during the drilling operation falls directly to the footwall. By this method dust accumulation is minimized. Bit penetration is at the rate of 15 in. per min. and face holes are 10 ft. deep. Thus, one operator in charge of the twin-boom prototype rig should be able to drill in excess of 500 ft. per shift.

Blast rounds comprise 60 holes per face, fragmenting to up to 300 tons per face each blast. Thus, a double of end and side walls provides some 600 tons of material.

With all this development, the improved productivity has enabled some miners to be released for other expanding projects within the factory, and yet increased the output of the mine to over 23,000 tons in a week, with only 80 miners working on each of the three producing shifts per day. Coupled with this high rate of production has been the achievement of an excellent record for safe working. This follows to some extent from the substitution of powered operations for manual labour, but great credit is given by the management to the co-operation they have received from union officials and shop stewards in the detailed investigation into the cause of every accident, and the willing way the men have accepted the management's Job Instruction Sheets detailing the safe way of doing each job.

This vast network of mine workings, growing bigger by nearly an acre each week, is producing the raw materials both for sulphuric acid and fertilizers made at the Billingham factory. To date, over 20,000,000 tons of anhydrite has been produced. No shortage can be envisaged for several generations at least.

The new Concentrated Complete Fertilizer Plant, which came into operation at Billingham in the autumn of 1958, is the largest granular fertilizer plant in Great Britain and one of the largest of its kind in the world.

Uranium in Australia

THE Sixth Annual Report of the Australian Atomic Energy Commission gives a comprehensive outline of developments to the year ended June 30, 1958.

Describing the search for uranium in Australia, the report first points out that during the year, in collaboration with State authorities, the Commission continued to sponsor broad surveys made by the Bureau of Mineral Resources. These surveys comprised both aerial and ground reconnaissance and indicated areas worthy of closer investigation. Various services such as assaying and borehole logging were also given by the Bureau, both services and surveys being financed from funds provided by the Commission.

Airborne radiometric surveys were carried out in the Northern Territory, Western Australia, Queensland, New South Wales and Tasmania. A total of 51,500 sq. miles was surveyed, compared with 51,000 sq. miles in 1956-57 and 27,800 sq. miles in 1955-1956.

Areas covered by high-level reconnaissance surveys included the Kalgoorlie-Jackson-Barlee area (18,500 sq. miles), the remaining 20,000 sq. miles of the Carnarvon Basin in Western Australia, the Cobar area (6,000 sq. miles) and an area near Broken Hill in New South Wales. Low-level reconnaissance surveys were carried out in the Calvert Hills and East Alligator River areas in the Northern Territory, in Queensland and in North-Eastern Tasmania. Detailed low-level surveys were carried out in the Rum Jungle, South Alligator River and Jervois Range areas in the Northern Territory. In all, regional geological surveys over a total area of approximately 12,500 sq. miles were made in the Northern Territory.

Other Activities

Other activities completed during the year included investigation of radiometric anomalies in the Rum Jungle district, the mapping of the uranium mine at Rockhole Creek, South Alligator river, the use of electromagnetic techniques for the testing of sulphide mineralization in the Waterhouse-Rum Jungle area, and detailed mapping in various areas of Queensland.

The Darwin Uranium Group of the Bureau of Mineral Resources provided geological, geophysical and radiometric services throughout the year, although it is reported that there has been a marked decline in interest in the search for uranium since the boom years. This decline of interest may be attributed to uncertainty regarding the future of the uranium market, as the primary demand—emanating hitherto principally from military sources—has now been outstripped by the rapid increase in world production. Yet reliable estimates suggest that world requirements for peaceful purposes alone are likely to exceed the current rate of production by 1970. The picture, therefore, is one of a somewhat difficult period in the years immediately ahead. The current lack of enthusiasm, among prospectors and developing companies alike in Australia no less than in other countries of the world, is thus logically explained, although it is certain that the longer range prospect for uranium leaves no room for doubt.

Indeed, to the year ended June 30, 1958, only four discoveries of radioactive minerals were reported to the Commission, of which one was a discovery of thorium-bearing minerals. No rewards for discoveries were paid during the year.

Ore treatment research undertaken during the year included efforts to devise a satisfactory method for treating the ore from Dyson's deposit, the second orebody at Rum Jungle, while Mary Kathleen Uranium Ltd. is investigating the possibilities of extracting thorium as well as uranium from ore won at the Mary Kathleen deposit in Queensland.

Other ore treatment research is being carried out by the Bureau of Mineral Resources, the South Australian Department of Mines, the Universities of Melbourne and Queensland and the New South Wales University of Technology.

In so far as mining itself is concerned, the year's production of uranium oxide at Rum Jungle was lower than in the preceding year because the grade of head feed to the treatment plant had declined. During the year under review 70,898 tons of uranium and uranium-copper ore was produced (71,628 tons in 1956-1957) with a uranium oxide content of 6.8 lb. per ton and a copper content of 2.6 per cent. Production totalled 443,807 lb. of uranium oxide in concentrate, and total contained copper output was 1,387 tons. Comparative figures for the previous year were 541,652 lb. and 1,406 tons. An additional 47,740 tons of copper ore were mined and stockpiled in the year 1957-1958 for future treatment.

Ore Reserves

Ore reserves at Rum Jungle, *in situ*, mined and in stockpile at the end of the period were 203,000 tons of uranium ore with a uranium oxide content of 6.8 lb. per ton, 109,000 tons of uranium-copper ore with a uranium oxide content of 6.3 lb. per ton and a copper content of 4.2 per cent, and 262,000 tons of copper ore with a copper content of 2.8 per cent. The installation of the counter-current decantation unit was completed at Rum Jungle, enabling a much higher percentage rate of recovery to be achieved. Since the beginning of mining operations at Rum Jungle, a large stockpile of base metal ores has been built up. These ores contain copper, lead and cobalt, and they cannot be treated in the uranium processing plant. Work has now begun on site preparations and foundations for a plant to treat base metal ores, and construction is expected to be completed early next year.

Recalculation of the ore reserves of the Mary Kathleen deposit shows that, in light of the latest development information, total reserves of recoverable uranium oxide are greater than was originally thought. These reserves are stated as being more than the company will need to complete its contract with the United Kingdom Atomic Energy Authority. Full-scale open-cut mining was carried out through the year and a large stockpile was built up. Successful rain-making experiments over the catchment area of the Corella Dam, together with an increase in the storage capacity of the dam, ensured water supplies until September, 1959.

Activity in the South Alligator River area is now confined to the activities of two companies which have been developing their uranium deposits to bring these to full production. The companies have undertaken their own treatment operations after the unsuccessful conclusion of the negotiations with the Combined Development Agency for the purchase by the Commission of uranium ore from the South Alligator River area. One of the companies, United Uranium N.L., purchased a treatment plant formerly used for gold extraction and is converting it for the production of uranium oxide by solvent extraction.

Malayan Aerial Survey Indicates New Areas For Prospecting

THE third extract from the Colombo Plan report of the airborne magnetometer and scintillation counter survey over six areas of the Federation of Malaya flown in 1956-57 has now been published, as *Economic Bulletin 1.2*, by The Geological Survey Headquarters, Ipoh (price M$5).

The latest bulletin deals with parts of the States of Trengganu and Pahang, both on the eastern side of the main mountain range of the Federation, whereas both previous bulletins covered areas on the western side. In addition to the technical report by Dr. W. Agocs, the chief geophysicist, the bulletin contains a chapter dealing with the geology of the Federation in general and of the area covered by the extract in particular, by Mr. J. R. Paton, principal geologist, Geological Survey, Federation of Malaya, and an interpretative summary by Dr. J. B. Alexander, Director of Geological Survey.

The Geological Report

Mr. Paton describes the area now under consideration as a long north-south strip of Trengganu, the most easterly State of the Federation, and a small part of the extreme north-east of Pahang, comprising in all some 2,396 sq. miles of country. Mainly because of the absence of fertile coastal plains and the difficulty of access into the interior, Trengganu is one of the least developed States in the country. The mountains run close to the coast and where recent coastal deposits do exist they are of quartz beach sands unsuitable for cultivation. There is one main road only, connecting the fishing villages from north to south. This is the one trunk road in the Federation of which sections remain with laterite surfaces. There is a short narrow gauge railway between the iron ore mine at Bukit Besi and the coast, the only rail track in the area.

There is a fairly extensive tin field situated in the Kemaman area in the extreme south of Trengganu, where a number of mines were being worked before World War II. The area is remote and access is by a long journey by road, river and track, which rendered impossible adequate protection against the Communist terrorists on the outbreak of the emergency in 1948; consequently the small mining community was withdrawn and the mines closed. Some of the mines have now reopened, but production is low.

Attempts to work small isolated tin and tungsten deposits in the north have been restricted by the emergency and none is at present in operation. Mr. Paton points out that at the present time the only mining revenue of note derived by the State is from the iron ore mine at Bukit Besi, west of Dungun, from which production has reached around 2,000,000 tons annually. This mine is situated on a high hill where weathering has taken place to considerable depths. The relationship of the magnetite orebodies is difficult to determine on account of the weathered state of the rocks and the origin of the primary deposit is a matter of some controversy. The only apparent association is with the granite.

The reason for selecting this area for aerial survey is stated to be that very little geological work had been done there, and the prevalence of swamps made ground investigation difficult. The presence of the Bukit Besi iron ore mine, and of a smaller iron ore deposit, now worked out, at Machang Satahun, West of Kemaman, indicated the possibility of further iron ore deposits in less accessible areas. Granite is abundant and the contacts when determined may prove profitable zones for exploration.

The Geophysical Report

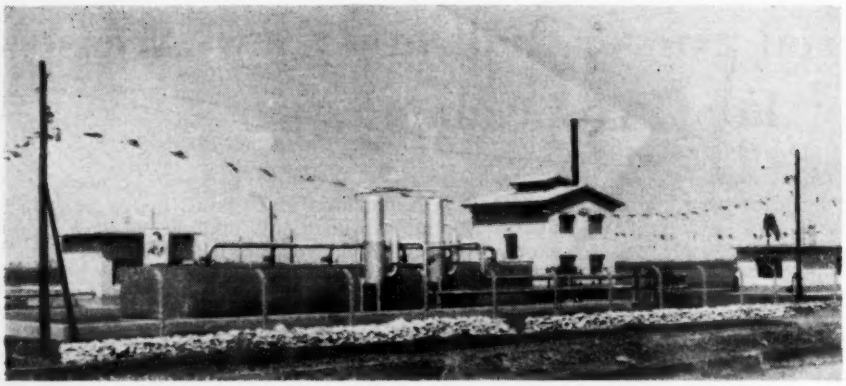
Dr. Agocs, in his technical report, deals in some detail with the magnetic anomalies and radioactive zones recorded in the survey, with appropriate map references. Here, space does not permit more than a statement of some of his generalizations. He reports that the area may be divided into three magnetic provinces—the small relatively intensive anomalies located along the northern and north-eastern edge of the survey area; the intermingled relatively intense magnetic anomalies in the south-eastern part in which there are sharp local anomalies; and the broad central zone characterized by low broad magnetic gradients, on which are superimposed minor magnetic features. These variations, says Dr. Agocs, may be related to, and interpreted as, variations in the magnetic content of the igneous rock and variations in depth of burial. The igneous rocks, mainly dolerites, in the extreme south-eastern part of the area are of the type in which magnetite tends to collect in local masses, which would account for the local sharp magnetic anomalies observed in that zone.

He describes as of considerable interest an anomaly located in the east central part of the area which is comparable to the anomalies observed for the iron ore concentrations of the Bukit Besi mine located to the north-west. Several of the magnetic and radioactive anomalies are considered worthy of fuller investigation, although most of the latter may be caused by clay concentrations.

In his interpretative summary Dr. Alexander points to five major zones of interest lying within an area of approximately 1,150 sq. miles to the south of Kuala Brang and west and north of Kemasik. This area was originally selected for aerial survey because the presence of the large Bukit Besi iron mine suggested the possibility of other deposits in less accessible areas and because the determination of granite contacts could indicate likely areas for profitable exploration. He concludes that the survey has revealed several anomalies which substantiate the likelihood of mineralization which will probably repay persistent intensive investigation.

Seven further major zones of interest are contained in a 1,200 sq. mile area lying west and south of Kemasik in Trengganu and west and north of Kuantan in Pahang. In this area Dr. Alexander considers that numerous irregular igneous masses and igneous/sedimentary contacts indicated by aeromagnetic control are likely to repay persistent intensive investigation by the discovery of additional mineral deposits of economic interest. He also concludes that some local radioactive high areas, each associated with a negative magnetic anomaly, should be investigated.

It appears probable that in the area covered by this bulletin, exploration and prospecting in the indicated zones will discover deposits of iron ore of a wider and greater economic value than had been previously contemplated. It is of some interest that Dr. Alexander, referring to postulated vague " fault " zones in the vicinity of Sungei Lembing, states that it is significant to note with what tenuous indications rich deposits of tin ore may become associated.



A new oil well in Serbia

Yugoslavia's Metal and Mining

YUGOSLAVIA'S mining and metal industries made further advances in 1958, and output continued to expand. Particularly noteworthy was the performance of the non-ferrous industry, which exceeded its target figure by more than 3 per cent. All other branches of the mining and metal industries, with the single exception of coal, achieved the outputs called for by the Plan.

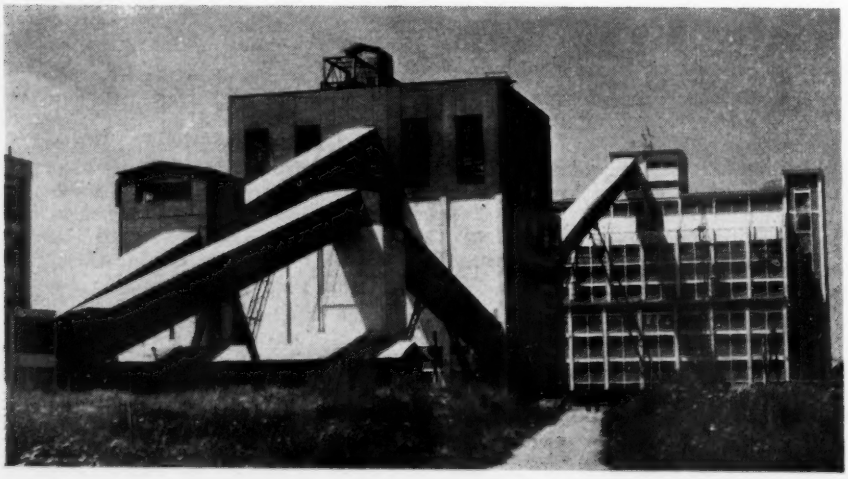
The achievements of the non-ferrous industry would have been even greater but for the fact that the demand for electrical power tended to exceed the available supply, which was a factor limiting the expansion of a number of operations in this field.

Substantial increases were recorded in the production of ferro-alloys (about 50 per cent), silver (30 per cent), copper mill products and aluminium ingots (20 per cent), copper ore and pyrites concentrate (18 per cent). Production of copper, lead and quicksilver remained at approximately the same level as in 1957, but due to a fall in exports the production of bauxite was smaller, and declines were also noted in production of antimony metal and bismuth.

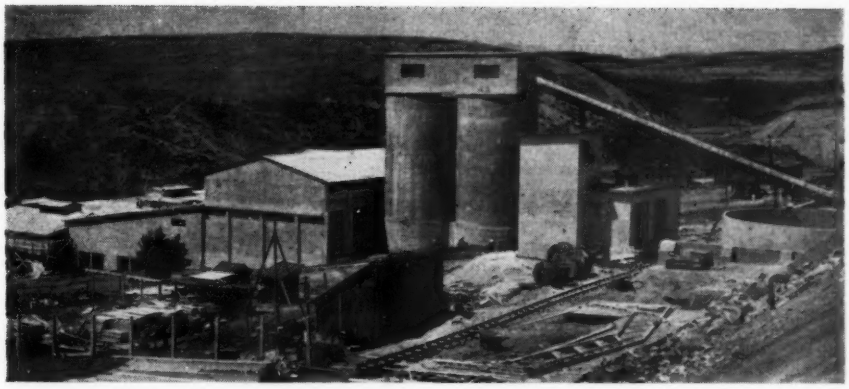
The year's generally improved results were made possible by the start of operations at several new undertakings such as the Kiznica lead and zinc mine, near Trepca (Serbia), the Janja Lipa opencast copper mine, near Bor (Serbia), electrolytic reduction of aluminium in the light metal works at Sibenik (Croatia), the clay and aluminium works at Kidricevo (Slovenia), the successful outcome of researches at the Bor mine (Serbia), and other important developments.

During the past year productivity increased significantly in this section of the economy, rising to 7 per cent, while non-ferrous metals headed the list of mining and metal exports, of which they accounted for some 58 per cent. For 1959, a further increase of up to 6 per cent over last year's production is anticipated for the non-ferrous industry, due to better utilization of existing capacities and to the relatively good supply of electrical power which will be available. The biggest increases in production are foreseen for aluminium ingot and for aluminium and lead-rolled products.

In the iron and steel industry, output as compared with that of 1957 was higher by more than 100,000 tonnes of crude steel, 50,000 tonnes of pig iron, and 80,000 tonnes of rolling mill products. The year's figures were 1,000,049 tonnes of crude steel, 714,000 tonnes of pig iron, and 664,000 tonnes of rolled products. These gains were attributable to the commissioning of new facilities at a number of iron and steel works, including those at Jasenice (Slovenia), Zenica, Ilijas and Vares (Bosnia and Hercegovina), and Niksic (Montenegro), and Vares iron mine.



Drying house at Kolubara



The Bor copper mine

Industries in 1958

By Branko Djukic

Now that the capital programme has been completed, Zenica—Yugoslavia's largest iron and steel works—has the capacity to produce annually about 700,000 tonnes of crude steel, 1,600,000 tonnes of pig iron, 500,000 tonnes of rolling mill products, and 600,000 tonnes of metallurgical coke. At Vares—the largest iron ore mine in Yugoslavia—an output of 1,400,000 tonnes is scheduled for the current year.

Productivity in the iron and steel industry declined last year, but to an insignificant extent, the falling off being ascribed to the fact that the construction and commissioning of new capacity led to an increase in the labour force without as yet permitting maximum utilization of the additional workers. It is expected that in the current year production in the steel industry will be 14 per cent higher than in 1958, due to the improved utilization of existing facilities, the commissioning of additional new capacity, and completion of the construction programme at Niksic.

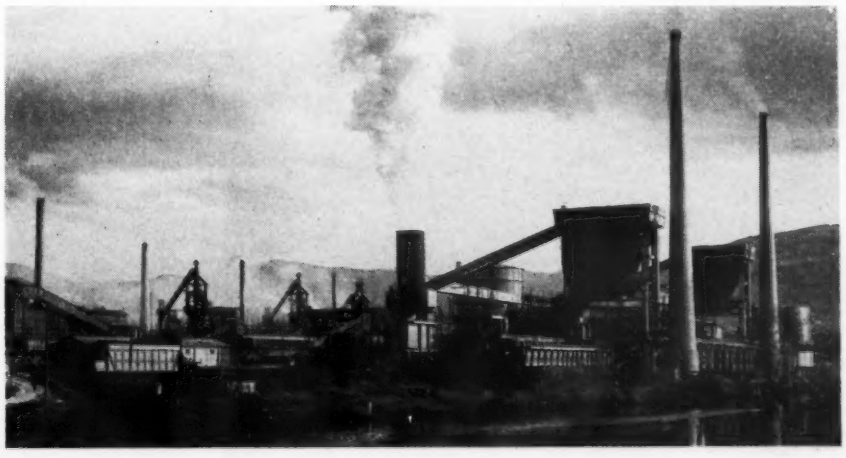
Substantial progress has also been achieved in the production and processing of non-metallic minerals, though this branch of the economy has been handicapped by a fall in exports of cement, barytes, and other products. The output of sintered magnesite, refractory materials, quartz, felspar and other materials has been expanded to a considerable extent.

Here again, the gains are ascribed to improved utilization of existing facilities and the starting up of new plants, among the latter being a large works for the production of refractories at Gostivar (Macedonia), a plant for manufacturing heat-insulating materials based on diatomite at Prilep (Macedonia), and the discovery of new reserves of kaolin and magnesite. In this industry, productivity has increased by about 4 per cent. This year a further increase of about 9 per cent is foreseen in the production of non-metals, due to better use of existing facilities and to the installation of more up-to-date equipment.

The production of crude naphtha rose from 395,000 tonnes in 1957 to 470,000 tonnes last year. This was due primarily to the exploitation of newly discovered naphtha-bearing fields, which will enable this industry to be expanded still more rapidly in coming years. Significant successes have been achieved in increasing naphtha reserves in Croatia and Serbia.

Yugoslavia's coal output amounted last year to nearly 19,000,000 tonnes, being about 1,000,000 tonnes higher than in 1957. This improvement came about largely as a result of increased production of lignite, for the outputs of brown coal and pit coal remained at the same levels as in 1957, the limiting factor in each case being consumption.

Production of coal is expected to reach 2,300,000 tonnes during the current year, this forecast being based on a further increase of about 8 per cent in capacity as compared with 1958, due to improved productivity and to more efficient utilization of the treatment plant at Kolubara.



The coke plant at the Zenica steelworks

Machinery and Equipment

Separating Asbestos Fibre from Crushed Rock

From experience gained from the operation of asbestos milling machines, the latest improved design has been produced and, according to *Asbestos* of March, 1959, interest is now being expressed from all parts of the world.

The Smith Separator is an inclined conveyor belt operating at a fairly steep angle and over drums at rather short centres.

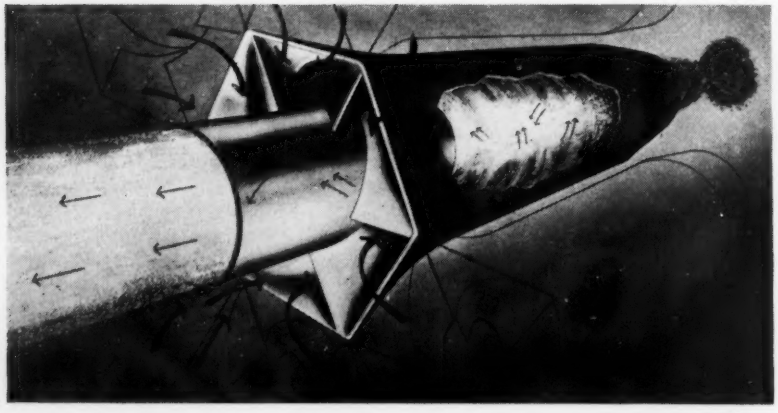
Instead of idlers, the belt is supported on rotating beaters operated by the belt. With a perforated belt or wire mesh screen, these beaters cause an excellent screening action that cannot be surpassed. The upside-down position of the return belt renders the belt self-cleaning and it never blocks.

The principle of this method of separating asbestos fibres is to provide a very thin layer of ore delivered by a controlled feeder and dropped a reasonable distance on to the belt. The tendency is for the rock to bounce, roll or slide off the belt or screen at the lower end. Since the belt is running upward and the fibre does not slide, it is delivered over the top. With a screen or perforated belt, fines pass through and are delivered below.

Depending upon the requirements of the user, two types of feeders may be employed. If a clean separation of rock and fibre is necessary, the intermittent type of feeder is used, which allows an instant for fibre and rock to become separated after contacting the process belt. The following supply of feed then lands on a clean surface for similar treatment. If a continuous feeder is used, a small portion of fibre may be carried down due to interference from rock particles moving toward the reject end of the process belt.

One of the great advantages of this method of separation is that it is now possible to feed and treat 25 to 30 tons of ore per hour with only 3 h.p. and without the use of costly aspiration equipment. Immediately after rock fibre-izing, the undamaged free fibre and fines may be separated and rock or sand may be passed for further treatment or discarded to tailings. Experiments to date have also shown a very efficient separation of free fibre from wet rock storage ore. This should have interesting developments due to reduction of drying costs in non-rotary types of dryers which can separate fibre and efficiently dry at the same time.

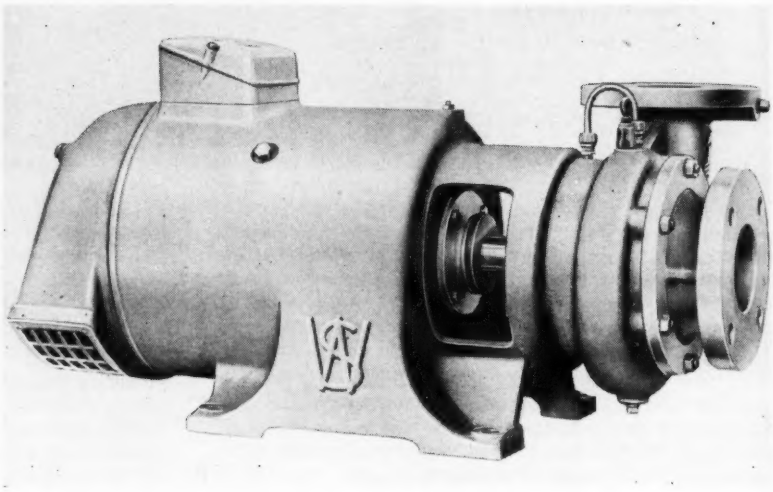
For new mill designs, it is estimated a space saving of 30 per cent is possible due to the elimination of aspiration equipment, with resulting proportional reduction in capital and operating costs.



Diagrammatic illustration showing how dust-laden gas enters the SPA element

ADVANTAGES IN MONOBLOC PUMPS

Advantages of the space- and weight-saving design of Monobloc pumps have been increased still further by the introduction of Class E insulated motor windings. As a result, Worthington-Simpson can now offer smaller, lighter pumps in their 1½ to 10 h.p. Monobloc range which give the same performance as comparable units previously fitted with Class A motors.



Worthington-Simpson Type "DM" "Monobloc" Pump with 10 h.p. Class "E" insulated motor

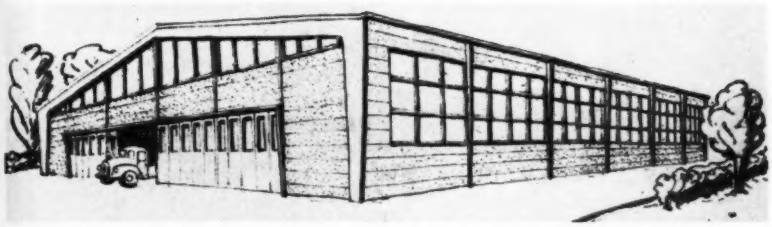
In the Monobloc pump range with Class E insulated motor, the motor is fitted to a two-stage Vortex pump and is rated at 5 h.p. The pump has a maximum capacity of 520 g.p.h. and a maximum head of 540 ft. depending on capacity. Dimensions and weight of this unit are: length, 2 ft. 1 in.; width, 9 in.; height, 1 ft. 2 in.; weight, 175 lb. By comparison, the same pump end fitted with a 5 h.p. Class A motor has a length of 2 ft. 0⅜ in., is 11 in. wide, 1 ft. 2¼ in. high, and weighs 216 lb.

DEFEATING DUST

Great interest is now being focused on the subject of air pollution and dust control. The Spa collector, a new dust collector, is manufactured under exclusive licence by Steels Engineering Installations Ltd., one of the Steel Group of Companies. The Spa belongs to the multi-cellular group of dry centrifugals, but nevertheless depends on a unique principle of selective particle acceleration. From this principle stem the advantages that collection is extended to the smaller particle sizes, collector wear is eliminated, and that, despite the high collection performance, the pressure drop and hence power consumption is low.

The Spa collector comprises a number of standard elements housed within a fabricated steel body with dust-collecting hopper. Each element comprises an inner and outer member assembled co-axially.

The outer member is formed in two parts: an operating zone and a cylindrical collector tube, the two being



Hewitt's of Cranleigh, specialists in tailor-made reinforced concrete buildings, have increased the clear, unsupported span of the reinforced concrete roof beams of their buildings to any span to 70 ft. wide. This has been achieved while also decreasing the pitch of the roof to 15 deg. The height to eaves of these buildings may be up to 20 ft. The relatively small pitch of the roof avoids the enormous roof space above eaves level internally and thus lowers heating losses and increases internal heating efficiency. The buildings have various applications in mining

welded together. The operating zone forms a funnel with rapidly decreasing cross-sectional area, the upper end being hexagonal in section and the lower end circular to match the cylindrical collector tube.

The inner member comprises a straight length of mild steel tubing, flanged at the top, passing centrally through the operating zone, co-axial with the collector tube and extending a little below the bottom of the operating zone. Within the annular space formed between the operating zone wall and the inner member are placed six guide vanes, these vanes being welded to the inside of the operating zone only.

Dust-laden air enters the element over its hexagonal face at low velocity. The guide vanes immediately deflect it into a helical path, and as it passes through the nozzle it is rapidly accelerated along this helical path by virtue of the decreasing cross-sectional area. The air emerges from the operating zone at a velocity of six times that at which it entered. It flows approximately two-thirds of the way down the collector tube in this helical path before reversing up the central core of the vortex to leave the element through the inner member.

The separated dust flows down the walls of the open-ended collector tube to be deposited in the hopper beneath. A straightening vane, placed inside the inner member, recovers some of the swirl energy and reduces frictional losses by restoring straight flow.

The manufacturers state that the patented feature is the acceleration of the air as it passes through the operating zone on its helical path. This acceleration is very rapid (the air traverses the nozzle in approximately 9/1,000ths of a second) with the result that the larger particles by virtue of their inertia attain lower speeds than the small particles. As the different sized particles are accelerated in their helical path (more or less rapidly in inverse ratio to their mass) they are acted on by increasing centrifugal force. When the centrifugal force acting on a particular particle is sufficient to overcome the viscous drag of the air in which it is immersed, the particle travels radially towards the wall of the operating zone to be collected.

Since the centrifugal force acting on the particle is proportional to its mass, which in turn is proportional to the cube of its diameter, and resistance to radial flow through the conveying air is proportional to the projected area or diameter squared, it is apparent that lower velocities are required to effect separation of the larger particles. Conversely, by accelerating the dust-laden air, sufficient centrifugal force is established early in the acceleration to separate the larger particles, leaving only the smaller ones to be accelerated to higher speeds to effect their separation.

This principle of selective particle acceleration brings in its train selective particle collection, by which the larger the particle, the earlier, and consequently the slower, is it collected. In this way the air stream is rapidly cleaned of the larger particles, thus permitting it to be accelerated to the higher speeds necessary to centrifuge the very small particles.

In support of their claims of high efficiency, the manufacturers quote figures of 80 per cent at 5 micron and 93 per cent at 10 micron with dust having a specific gravity of 2. Low erosion is supported by many industrial installations on the Continent and in the United States, where examination has revealed no abrasive action. At normal rating resistance is 4 in. w.g. at 60 deg. F.

SHAFT SIGNALLING IN COAL MINES

The growing number of more efficient winding plants being brought into operation in coal mines created a need for a shaft-signalling system which would enable full advantage to be taken of their faster speed and larger capacity. A new system, known as Type 57, has been developed by A. T. and E. (Wigan) Ltd. to meet this need and is now in operation at Rufford and Warsop Collieries, Notts.

Chief advantage of the system is that it enables each signal to be automatically sent by simply pressing the appropriate pushbuttons: this eliminates the tedious task of impulsing by hand and reduces the possibility of wrong signals being transmitted.

The audible signals are transmitted automatically and at constant speeds. A miniature indicator panel at each level keeps all personnel concerned informed of the signals given from other positions and gives each onsetter visual confirmation of the signal he has sent. The system is extremely simple to use, and in the event of an emergency could be operated by unskilled personnel.

AIR-BREAK CIRCUIT BREAKER

Completing the range of Belmos equipment designed to comply with N.C.B. specifications, the SBU.1 is a hand-operated air-break circuit breaker designed in accordance with N.C.B. Specification P 7/1950 and certified flameproof by the Ministry of Power under Certificate No. 4242 for Group 1 gases.

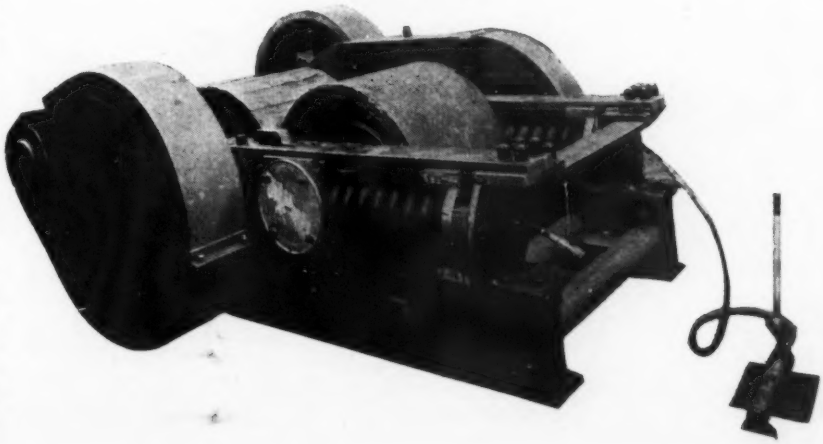
Continuously rated at 200 amp., the breaker has been tested in accordance with B.S. 936:1940. It has a breaking capacity of 9,000 amp. at 650 v., 0.25 power factor, equivalent to 10 mVA., and a making capacity of 21,200 peak amp. at 650 v.

ADDITION TO CRUSHER RANGE

Outstanding feature of the latest addition to the Rollsizer range of roller-bearing crushing rolls made by Frederick Parker Ltd. is a small but sturdy hand-operated hydraulic pump for spring tension adjustment. The new model—size 30 in. x 24 in. (76 cm. x 61 cm.)—is the largest in the range and has outputs of 32 to 75 tons an hour. The new model has been introduced to meet the demand for stone crushed to minus ¾ in., although it is adjustable to produce smaller or larger sizes.

The Rollsizer has a fabricated steel frame and hard-wearing rolls of manganese steel, and is internally machined and taper-mounted for quick and accurate assembly. The roll shafts run in heavy-duty self-alinging spherical roller bearings, labyrinth-sealed against dust.

The new Parker Rollsizer roller-bearing crusher, showing the hand-operated hydraulic pump



MINING MISCELLANY

The Iranian Minister of Industry and Mines, His Excellency Sharif Emami, arrived in the U.K. on Monday, May 25, for a two-weeks' visit to this country as the guest of the Board of Trade and the Advisory Council on Middle East Trade (ACMET).

★

Reuter reports that Japanese machinery manufacturers are believed to be discussing a proposal that potash manufacturing equipment worth $U.S.15,000,000, should be supplied to Israel on deferred payment terms. The proposal was made to the Japanese Consultant's Institute, an association of Japanese machinery makers, by an Israeli trade mission which visited Tokyo earlier this month. When arrangements are made for one of the Japanese manufacturers to supply Israel with the required equipment, the project would be submitted to the Japanese Ministry of Trade for approval. If approval was given, credit for the deferred payment would be supplied by the Japanese Export-Import Bank.

★

According to reports in the Stockholm press, the Bethlehem Steel Corp. has joined the big Liberian iron ore project as a 25 per cent partner. Preparations for the exploitation of the rich deposits have been carried on under direction of Swedes by the Liberian American-Swedish Minerals Co. (LAMCO) since early 1955. Bethlehem will take one-fourth of the future production estimated at 10,000,000 tons per year, while the LAMCO share, according to an agreement valid for 20 years, will be sold and shipped by the Stockholm mining company Grängesberg, leading partner in the group of Swedish companies participating in the project. This company will also be responsible for the projecting and the future mining activities. The new agreement has been approved by the Liberian Government, which owns half of the share capital in LAMCO.

★

Large orders for Queensland coal, worth nearly £3,000,000 a year, are expected to be placed by Japan if surveys of the Kianga coalfield, to be carried out by Japanese companies next month, are favourable. Thiess Bros. Ltd. are seeking a contract to supply 500,000 tons of coal per annum from the Kianga field to Japan's booming steel industry. Kianga is a new coalfield, 527 miles northwest of Brisbane.

★

Negotiations for a loan to be raised by the Emergency Committee of West German Coalmine Owners to finance the buying off of contracts for United States coal imports are reported to be concluded. The loan is in the region of 225,000,000 mark, and is to be repaid within three or four years at less than 5 per cent. The German Government has guaranteed the loan. Repayment is to be made through a surcharge of 1 mark per ton of coal produced. According to the German economic news agency, VWD, the whole cost of buying off the contracts to import United States coal is in the region of 300,000,000 mark. Buying off became necessary when the West German Government levied a customs tax on coal imports last September to combat the coal surplus at home.

★

Production at the Mantos Blancos copper deposit, owned by the Mantos Blancos Mining Co., of Antofagasta, North Chile, will total about 1,500 tonnes of 99.75 per cent refined copper monthly when operations start in mid-1960. Reserves of copper ore are estimated at 10,500,000 tonnes. So far the company has invested $8,000,000 in the installations, and this expenditure will have increased to about $18,000,000 by the time exploitation begins. Mining will be by open-cast methods.

★

The Paposo copper deposit, situated in the province of Antofagasta, Chile, has been sold to a Canadian consortium, whose identity has not been disclosed, for 550,000,000 Chilean pesos. The deposit was formerly owned by the Sociedad Latorre Prenafeta. Exploration will be started shortly.

★

The project to extract manganese ore from deposits in the Northwest District of British Guiana is reported to be proceeding satisfactorily. Mining operations are scheduled to begin in November, 1959, and full production is expected in 1960 at the rate of 30,000 tons per month. This $20,000,000 project is being financed by the Union Carbide Corporation, whose agent in British Guiana is the African Manganese Co. (Mines Management) Ltd.

★

Syria's Five-Year Industrialization Plan includes the following projects in the mining field: exploitation of deposits of lead, radioactive minerals, and bauxite; exploitation of asphalt, gypsum, and clay products; scientific exploitation of salt deposits in Syria. According to the Minister of Industry, Mr. Wajih Summan, under an agreement with the Soviet Union, Russian geologists will prospect for chromite, manganese, iron ore, and oil.

★

Miami Copper Co. has announced that it will curtail mining operations at its underground mine late next month. The mine will continue to produce copper, however, by leaching its caved-in portions. The leaching process is expected to produce 9,000 s.tons a year initially, compared with the present rate of 12,500 tons and previous rates of as high as 30,000 tons. Miami Copper's Castle Dome and Copper Cities open-pit operations are not affected.

★

It is now estimated that the exploitable iron ore in the famous "Kursk Anomaly" will suffice for the iron and steel industries in the southern and central parts of the U.S.S.R. for many years to come, and will produce a surplus for export. A deposit, located in 1954, has ore of a pure metal content of 65 to 66 per cent.

★

The Bureau of Mines, U.S. Department of the Interior, is renewing its investigation of bauxite deposits in Hawaii, and will conduct extensive testing of specimens to see if an economic method for extracting alumina can be developed.

The Elliot Lake thorium plant of Rio Tinto Dow is now in regular production on all planned products. Trial shipments of the various products have recently been made and the plant is thus established as a major new source of thorium raw materials. The operations are based on the use of solvent extraction for the recovery of thorium from the waste liquors produced in the uranium milling operations of the Blind River area. This first operating unit is located adjacent to the Quirke Mill of Algom Uranium Mines and, at such time as the market warrants further production, units can readily be constructed to take advantage of the waste solutions from other mines in the area

CONTRACTS AND TENDERS

U.S.A.

One 10 in. floating hydraulic suction dredge, diesel engine powered and rotating cutter head type, spuds and pontoon hull. Operation by swing lines; swing lines and anchors. Draft to be minimum not exceeding 3 ft. Output, 110 cu. yds. per hr. from 20 ft., with 2,000 ft. discharge pipe to 10 ft. elevation. Closing date, June 11, 1959. Issuing authority U.S. Department of the Interior, Bureau of Reclamation, Building 53, Denver Federal Centre, Denver 25, Colorado, U.S.A. Ref. ESB/12390/59. Telephone inquiries to Chancery 4411, extension 738 or 771.

Union of South Africa

Two rubber-tyred rock wagons of 20-25 tons capacity of material, weighing approx. 100 lb. per cu. ft. Diesel powered developing 200 b.h.p. minimum. One rubber-tyred rock wagon of 9-12 tons capacity of material weighing approx. 100 lb. per cu. ft. Closing date, June 22, 1959 (first), and June 29, 1959 (second). Bids to the Secretary, Union Tender Board, 291 Bosman Street, P.O. Box 371, Pretoria. Ref. ESB/12768/59 and ESB/12660/59 respectively. Telephone inquiries to Chancery 4411, extension 738 or 771.

India

120 tonnes tractor-trailer combination unit. Closing date, July 3, 1959. Tender notice by Neyveli Lignite Corp. (P) Ltd. Ref. ESB/12218/59. Telephone inquiries to Chancery 4411, extension 738 or 771.

Belgium

Four trimming grabs and four ore grabs for floating cranes. To operate in coarse and fine ores. Closing date, June 18, 1959. Bids to College van Burgemeester en Schepenen, ten Stadhuize, Antwerpen. Ref. ESB/12119/59. Telephone inquiries to Chancery 4411, extension 738 or 771.

Korea

Coalfield test drilling equipment; various. Closing date, June 12, 1959. Bids to Office of Supply, Government of the Republic of Korea, Seoul, Korea. Ref. ESB/12293/ICA. Telephone inquiries to Chancery 4411, extension 354.

Taiwan (Formosa)

9,800 ft. hollow round drill steel. Closing date, June 15, 1959. Bids to Central Trust of China, Purchasing Department, 68 Yen Ping Nan Road, Taipei, Taiwan (Formosa). Ref. ESB/12145/59/ICA. Telephone inquiries to Chancery 4411, extension 354.

Coming Events

The eleventh annual meeting of the British Electrical Power Convention is being held in Torquay from June 1 to June 5, 1959. Chairman is Mr. C. R. King, deputy chairman of the Central Electricity Generating Board.

★

A general exhibition of the electrical equipment industry will be held in the C.N.I.T. Exhibition Building in Paris from June 12 to 28 next. It is designated "Electrama". Charbonnages de France will display a reconstruction of a working face in a coal mine which will show the growing role of electric equipment in underground mining.

Metals and Minerals

Developments in Titanium

Progress in titanium technology continues to open up new horizons for the commercial development of this young metal. In the annual report of Imperial Chemical Industries, referred to in our issue of April 24, page 441, reference was made to the discovery of a simple, but very effective, electrochemical process enabling titanium to be used under certain fiercely corrosive conditions that would normally destroy it. The process depends upon coating the titanium with an extremely thin, and not necessarily continuous, film of platinum. Titanium so treated, it was stated, can be used with advantage, for example, as anodes in brine cells and in other electrolytic processes.

The development of a new titanium alloy, also based on the addition of a noble metal, to increase corrosion resistance, has been announced in the United States by Union Carbide Metals. It was stated that titanium, which is resistant to oxidizing acids (such as nitric acid) has been made resistant to boiling solutions of reducing acids (such as hydrochloric acid) by the addition of as little as 0.1 per cent of palladium.

It is anticipated that in many cases the benefits to fabricators of processing equipment from the use of titanium with noble metal additions will outweigh the increased cost of the material, and that these new alloys will lead to a further widening of titanium's markets. The material cost of making palladium additions of up to 0.1 per cent amounts to 28 c. per lb., based on a palladium price of $19 per troy oz. The noble metal additions have no effect on the mechanical properties of titanium or the ease of fabrication.

Among the most interesting of the new developments so far announced this year was the introduction of titanium carbide tool bits, claimed to outwear tungsten carbide grades for semi-finish and finish machining. These tools, which were developed by the metallurgy department of Ford Motor Company's scientific laboratory, are expected to be competitive in cost with present tool materials. In one test, tungsten carbide cut about 85 lb. of metal, while the titanium carbide went through more than 2,000 lb. It was stated that Ford has no plans, at the present time, for offering the new tool bits for sale outside the company. However, consideration is being given to the possibility of licences with other companies that might desire to begin commercial production of titanium carbides.

Notwithstanding the recent setback to the titanium industry, there is certainly no cause for pessimism as to the future of an engineering material with such dynamic possibilities as are clearly unfolding for this light metal, particularly in the very large and important field of corrosion prevention.

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British Titan Products Co. has announced the completion of a major extension to its titanium pigments plant at Grimsby, bringing the total annual output of the plant to 70,000 tons.

LONDON METAL AND ORE PRICES, MAY 28, 1959

METAL PRICES

Aluminium, 99.5%, £180 pe ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Crude (70%) £190 per ton
Ore (60%) bases 19s. 6d./20s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 9s. 0d. lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium 99.99%, Ge. kilo lots 2s. 5d. per gram.
Gold, 249s. 7d.
Iridium, £23/£25 oz. nom.
Lanthanum (98/99%) 15s. per gram.
Manganese Metal (96% - 98%) £245/£250
Magnesium, 2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £21/£23 oz. nom.
Osmiridium, nom.
Palladium, £6 10s./£7 10s.
Platinum U.K. and Empire Refined £28 10s. oz
Imported £27/£27¼
Quicksilver, £77½ ex-warehouse
Rhodium, £41/£45 oz.
Ruthenium, £18/£20 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 78¼d. f. oz. spot and 78¼d. f'd
Tellurium, 15s./16s. lb.

ORES AND OXIDES

Bismuth			65% 8s. 6d. lb. c.i.f. 18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—			
Rhodesian Metallurgical (semifriable) 48%	(Ratio 3 : 1)		£15 15s. 0d. per ton c.i.f.
,, Hard Lumpy 45%	(Ratio 3 : 1)		£15 10s. 0d. per ton c.i.f.
,, Refractory 40%			£11 0s. 0d. per ton c.i.f.
,, Smalls 44%	(Ratio 3 : 1)		£14 0s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio 3 : 1)		£11 15s. 0d. per ton f.o.b.
Columbite, 65% combined oxides, high grade			nom.
Fluorspar—			
Acid Grade, Flotated Material			£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)			156s. 0d. ex works
Lithium Ore—			
Petalite min. 3½% Li_2O			40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O			40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O			£25 0s. per ton f.o.b. Beira
Magnesite, ground calcined			£28 0s./£30 0s. d/d
Magnesite Raw (ground)			£21 0s./£23 0s. d/d
Manganese Ore Indian—			
Europe (46% - 48%) basis 57s. 6d. freight			nom.
Manganese Ore (43% - 45%)			nom.
Manganese Ore (38% - 40%)			nom.
Molybdenite (85%) basis			8s. 11d. per lb. (f.o.b.)
Titanium Ore—			
Rutile 95/97% TiO_2 (prompt delivery)			£31/£33 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2			£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)			98s. 6d./103s. 6d. per unit c.i.f.
Vanadium—			
Fused oxide 95% V_2O_5			8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65 -66% ZrO_2)			£17 0s. ton c.i.f.

WOLFRAM HIGHER

Wolfram prices have moved up somewhat since our last and London dealers are now quoting 98s. 6d. to 103s. 6d. per l.ton unit c.i.f. Europe against 95s. to 100s. previously. The market is still without any substantial tonnages on offer, and it is significant that some business is being done near the top end of the present price range. It seems to be generally accepted that stocks in Europe have been appreciably run down in recent months and the shortage of offerings may well imply an attempt by the producers to take advantage of this tighter position.

New York quotations have also firmed up and are now understood to be $12\frac{1}{2}$ to $13 per s.ton unit against $11\frac{1}{4}$ to $11\frac{1}{2}$.

Another straw in the wind may be seen in the news that the 12-month sales contract between the Korea Tungsten Mining Co. and the Continental Ore Corporation in the United States, which expired in January this year, has been renewed on the following revised terms: An increase in the minimum sales price from $9 to $12 per s.ton unit; payment at the time of shipment to be increased from 80 to 90 per cent of the negotiated price; minimum monthly shipment reduced from 350 to 250 tons, but subject to revision as market conditions warrant.

According to a report published by the Mining Industry of Korea on January 25, 1957, reserves of tungsten trioxide (65 per cent WO_3) in North and South Korea combined totalled 387,000 tons—North Korea 232,000 tons and South Korea 155,000 tons.

U.S. STOCKPILE LEGISLATION

In Washington this week, thirteen senators sponsored new legislation to ensure that the $1,000,000,000 Defence Production Act stockpile cannot be liquidated without prior Congressional approval.

At present, the executive branch does not need prior Congressional approval to unload the stocks acquired under the 1950 Defence Production Act, although approval is required to dispose of some 75 key industrial materials in the basic "national" stockpile and the so-called "supplemental" stockpile.

Some anxiety has been voiced in market circles lately regarding the possibility of appreciable tonnages of United States stockpiled copper, cobalt, and nickel, finding their way back on to the open market.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

Although prices have failed to maintain the high levels touched at the beginning of the week, the undertone of the market continues very satisfactory. Especially in the case of copper and tin, there are factors the outcome of which will have a marked effect on the course of prices for both metals in the immediate future; hence there is an increasing tendency to await these developments.

LONDON "BACK" REFLECTS COPPER STRIKE FEARS

The main feature of the London copper market has been the disappearance of the gradually diminishing contango and establishment of a backwardation. Apart from being due to technical considerations, as fresh European demand is quiet, it is to some extent connected with the current situation in America, as considerable quantities of prompt metal have been delivered to the market for possible ultimate shipment to the United States in the event of a strike developing. This latter factor still overhangs the market with just a month until the deadline date for agreement to be reached on a new labour contract. One school of thought is of the opinion that the outcome of similar talks in the steel industry will have a considerable bearing on the way the copper negotiations develop.

A firm trend in London at the end of last week anticipated a possible $\frac{1}{2}$ c. rise in the customs smelter price. Demand for copper from this source, mainly for delivery before the end of June, has been satisfactory, and undoubtedly more metal could be sold than their limited supplies permit. In an effort to bring out more scrap, offerings of which have been recently very slow, the smelter buying price was increased $\frac{1}{2}$ c. to $26\frac{1}{4}$ c., equivalent to $32\frac{1}{2}$ c. for refined for August delivery. Demand for producer copper is brisk at $31\frac{1}{2}$ c. and indications are that June supplies are all but sold. The third source of copper in the United States, namely the dealers, was quoting $33\frac{1}{4}$ c. for refined a week ago, but interest at this premium was negligible.

Conforming with the generally higher levels, the Belgian price was increased to 33.25 Belgian frs. per kilo, equivalent to 30.15 U.S. c. New York (exclusive of U.S. duty of 1.7 c.) and Antwerp. In spite of good business in physical metal, the United States consumption figures for April were disappointing and brought a dampening effect to the market, with sharp declines both in London and on the United States futures market, and lessened the prospects of any immediate customs smelter price increase.

The main points in these figures showed that new business booked by fabricators declined to 113,269 tons compared to the March figure of 161,693 tons. Fabricated products consumed 120,680 tons, and although this is appreciably more than a year ago, it shows a decline compared to the March figure of 133,259 tons. Fabricators' stocks at the end of April rose some 14,000 tons to 463,582 tons.

During the week the Board of Trade announced that they would be inviting tenders for the balance of 6,000 tons of copper for delivery from July to November this year. This is the final quantity left out of the 30,000 tons which they announced would be sold at the end of last year. United Kingdom stocks in official warehouses at the end of last week showed a rise of 250 tons to 11,516 tons.

TOO SOON FOR NEXT TIN QUOTA INCREASE

A little better demand for tin developed during the week, both from the United States and Europe, but latterly buyers have withdrawn pending the outcome of the International Tin Council meeting now being held in Copenhagen. There are certain matters to which the Council are undoubtedly giving their attention. Firstly, export quotas for the next three months' control period beginning July 1 must be fixed; and secondly, the disposal of some 2,500 tons of tin metal in the United Kingdom stockpile. As regards the former, it will be recalled that quotas for the current period were increased by 3,000 tons to 23,000 tons, and the market has absorbed this additional metal plus appreciable buffer stock sales and maintained a price over the £780 level. A possible steel strike in the United States, and the fact that the U.S.S.R. has not disposed of its agreed early export quota of 13,500 tons, will be taken into account.

As long ago as December, 1956, the Board of Trade announced their intention to liquidate their stocks, but action was delayed when prices fell prior to the International Tin Council supporting the market. Under the terms of the Tin Agreement, six months' notice to sell must be given, and it may be calculated that by the latter part of the year the buffer stock should be substantially lower.

On Thursday morning, the Eastern price was equivalent to £811$\frac{5}{8}$ per ton c.i.f. Europe.

NO CHANGE SEEN IN U.S. LEAD-ZINC QUOTAS

Lead and zinc demand, particularly in the United States, continues very satisfactory, but in spite of this and the production cutbacks announced after the recent U.N. meeting, there is little likelihood of any modification in the United States import quota policy for these metals. On the London market, withdrawal of support for the nearby position in lead has resulted in the contango widening, whilst in the case of zinc shortage of prompt metal has justified a widening in the backwardation.

The United States lead price might well have been increased during the week but for the fact that if London did not follow, the span between the two quotations would have been increased. The United States zinc price would also have been raised, but the possible strike in the steel industry remains a restraining influence, as it would close one of the major outlets. Statistically, zinc is in a good position with supplies of high-grade especially far from plentiful.

Closing prices are as follows:

	May 21		May 28	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£238	£238¼	£241	£241¼
Three months ..	£237¾	£238	£240¼	£240½
Settlement ..	£238¼		£241¼	
Week's turnover	6,775 tons		11,125 tons	
LEAD				
Current ½ month	£70½	£70⅝	£70¼	£70⅜
Three months ..	£71⅛	£71¼	£71⅛	£71¼
Week's turnover	4,875 tons		6,450 tons	
TIN				
Cash	£784¼	£785	£784	£785
Three months ..	£785	£785½	£784	£784¼
Settlement ..	£785		£785	
Week's turnover	800 tons		530 tons	
ZINC				
Current ½ month	£77¼	£77⅜	£78¼	£79
Three months ..	£75½	£75⅝	£77⅛	£77⅜
Week's turnover	6,075 tons		6,825 tons	

Mining Finance

New Pattern in Mine Financing?

The Anglo American Corporation's report for 1958 leaves a strong impression that a new epoch is about to begin. As a result of the deals with American-South African, the generally better market conditions, and the abating of the capital hunger of the new O.F.S. and Klerksdorp mines, the Corporation's liquidity is at a higher level than has been seen for many years. In addition, the higher levels of production on both sides of the Atlantic will mean substantial improvements in revenue from base metal producers to add to the constantly increasing level of receipts from the new gold mines.

Special interest, therefore, attaches to the exploration activities of the Corporation. These activities are performed by subsidiary companies operating in all parts of the Africas, and although no new flotations are immediately foreshadowed in the annual report, there can be no doubt that the tempo of prospecting is rapidly increasing. Extensions of the Rand-Klerksdorp-O.F.S. system are being sought for in all the likely (and some unlikely) parts of the Transvaal and O.F.S., while in the Rhodesias large areas are being explored for copper, gold and other minerals.

The pressure of idle money makes it certain that new investment opportunities will be found, but it remains to be seen how these new projects will be financed. A trend towards public flotation at a later stage of a mine's development has been noticeable for some time past. Coupled with this has been the growth of such companies as Ofsits and Writs, through which an investor can spread his risk over several mines in a given area and at similar stages of development. The policy which, hitherto at least, has been followed by these companies is quite distinct from, for example, Rand Selection, which adjusts its portfolio to meet changing market conditions.

It is possible, therefore, that the future lies with a combination of these two developments. The development of a future O.F.S. field might well follow a pattern such as this. First, prospecting by an exploration subsidiary; then hiving off by the parent company of a subsidiary holding which would initially hold the entire capitals of the individual mines and through which loan and equity finance would be provided for the new mines; and finally, the public flotation of the holding company's shares when the mines are approaching the production stage.

Such a system would have several advantages from the investor's point of view. His risk would be spread, and the financial stability of a group of mines would be superior to that of any of its constituents. Above all, there would be no more need to bet on boreholes in order to buy at low prices, and although opportunities for astute speculators would be limited, this is of small account compared with the stability of the market as a whole.

The financial statements in the report this year are most impressive. The market value of the Corporation's investments rose by £24,000,000 to reach a level only £4,000,000 below £100,000,000. The value of the shares held by the finance companies of the group rose from £240,000,000 to £360,000,000. Coupled with an increase in taxed profits of almost £1,000,000, it is not surprising that Mr. Harry Oppenheimer describes 1958 as a satisfactory year.

IS W.R.C. CHEAP?

In 1952 West Rand Consolidated was a dying mine. If it had been suggested at that time that six years later the mine's gross profit would exceed £2,800,000 (last year's figure), the idea would have been dismissed as ludicrous.

The factor which changed West Rand's prospects was, of course, uranium. First of the South African mines to be granted a C.D.A. contract, West Rand's uranium section was virtually a new mine, and although the gold section continues to add about £140,000 annually from the milling of 2.9 dwt. ore, these profits are insignificant in relation to the total.

In these circumstances, the question of West Rand's competitive position after the expiry of the contract in 1963 becomes of vital importance. At the present price of gold, operations in the gold section would be very much in the balance. Certainly, without substantial earnings from the uranium section there would be no possibility of maintaining the ordinary dividend at anything like the 4s. 3d. which has been paid in recent years. It is this situation which has forced up the yield on the ordinary capital to its present level of about 17 per cent.

Whether such a yield is justified is quite another matter. If a clear 8 per cent is required from the shares, a yield of 17 per cent implies an expected dividend life of about eight years. There is no reason to believe that the distribution rate will be reduced during the currency of the contract, so that valuation hinges upon whether or not the present rate can be maintained for more than the equivalent of three years after 1964. If it can, then any earnings after that date will be 'free", the capital having been fully amortized. Similarly, a break-up after that date would be clear profit.

A comparison between this supposed post-contract life and the current uranium ore reserve level shows that if reserves were no more than maintained until the end of the contract (in fact they have been rising steadily) four years of life would remain, even if those four years were devoted merely to stoping out developed ore. A fall in the price received during this period might be offset by a reduction in costs so that the least profitable course—picking out the eyes of the mine—would still result in a profit for buyers of the shares at the present price.

This, of course, takes no account of an increase in the gold price which would be of considerable advantage to West Rand. Although the direct benefit

(*Continued on page 599*)

LONDON MARKET HIGHLIGHTS

South African Gold shares started the week in fine fettle. Once again it was the Cape that provided the mainspring of the bull market movement. London and the Continent did little more than follow Johannesburg's lead. A certain amount of hesitancy developed on Tuesday but by the following day the Kaffir market was again steaming full ahead.

A feature of the movement was the broadening of demand. All sections were active participants in the rise. Western Holdings, among the newer mines, were consistently strong and rose 7s. to a best-ever 160s. They seem to be rapidly catching up now on Free State Geduld and part of the reason for the slow-down in the rise of this latter share lies in switching operations into Holdings.

Older mines moved ahead on a fair demand—thought to have emanated from the U.S.—and a shortage of stock was soon disclosed. Durban Deep, for instance, jumped to 36s. and Crown advanced to 27s. 6d. City Deep (21s. 9d.) were wanted by the Cape, particularly when talk was heard there of an extension of the mine's life.

Finance shares were strong on a gathering investment demand in which London played an important part. Local investors often fight shy of committing themselves to any individual mine and the risk-spread of finance shares coupled with their obvious growth prospects make them a popular choice. Rand Selection moved ahead consistently to 57s. 3d. while Anglo American spurted to 190s. 7½d. in front of the encouraging annual report. West Wits (66s.), "Writs" (62s.) and Rand Mines (98s. 9d.) were among others to go ahead. In the Diamond group, there was a continued demand for De Beers (153s. 9d.).

Copper shares came back into favour under the lead of Chartered (96s.) and Nchanga (12). Tins also began to brighten after some previous dullness but little real business can be expected to develop until it is known whether the current meetings of the Tin Council will fix bigger export quotas for the mines in the third quarter of the year. Siamese tumbled to 8s. 7½d. on the sharp fall in profits, although second thoughts helped by the satisfactory dividend brought about a recovery to 9s. 1½d. The higher Ampat final dividend was unexpected and these shares soon rose to 10s. 4½d. Lead-zincs fluctuated rather nervously.

In the miscellaneous group, Rio Tinto were persistently dull and drooped to 48s. 1½d. on growing doubts about the uranium market when contracts expire in the early 1960's.

There was no checking the ebullience of Retia Phoenix. Despite having risen from a nominal 3d. per share in the previous week, Retia bounded further ahead to 7s. 6d. There is still no official news about what is afoot, but the current theory is that a deal has been done in the shares and that a new future lies before the company.

CHAIRMAN'S STATEMENT: ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED
(Incorporated in the Union of South Africa)

Racial Policies in Southern Africa

MR. H. F. OPPENHEIMER REVIEWS ANGLO AMERICAN CORPORATION'S DEVELOPMENTS IN 1958 AGAINST POLITICAL BACKGROUND

CONFIDENCE IN FUTURE OF UNION AND FEDERATION IN SPITE OF DANGEROUS PROBLEMS

THE *following are extracts from the statement by the chairman,* **Mr. H. F. Oppenheimer,** *which has been circulated to members:*

The Anglo American Corporation is rooted in Southern Africa. We would certainly be prepared to do business in other parts of the world, but other things being equal, we prefer to do business here. And, in fact, all but a negligible proportion of our investments have been made in the Union and the Rhodesias. We are conscious, of course, that many people are worried about the ultimate effect of the racial policies followed in the Union, that the disturbances in Nyasaland have raised grave doubts about the future of the Federation, and that, for these reasons, the economic growth of both countries has slowed down. In the circumstances I think that shareholders would wish me to say something of the political environment in which we are working.

The Union and the Rhodesias have comparatively large European populations with no other homes. They are determined to stay in Southern Africa and to create conditions in which their children and grandchildren can stay there also. Any political approach which does not accept that fact is unrealistic and useless. Nyasaland is different from the other territories. It is an African country with a very small European population. The question there is not so much of building up a multi-racial country, but rather of finding a fair way for an African territory to be associated with multi-racial territories in one political system. Apparently there are African nationalist leaders who think any such association intolerable and seek to destroy it by methods of violence. The overwhelming economic advantages of Federation are summarily rejected in favour of what is called "freedom", regardless of the danger that the course they pursue would mean years of poverty and stagnation for the vast majority of the population.

Nevertheless, whatever the material benefits of the association to Nyasaland, it is plainly not going to be workable unless the policy of partnership is honestly and intelligently implemented, not only by the Government but by individuals in the daily life of the two Rhodesias. It is not going to work either unless African opinion and aspirations in each of the federated territories are fairly represented in the central Government.

The question that must be answered is whether the Federal Government and Europeans in the Federation as a whole are sincere in the racial policy they profess. I am convinced they are. Criticism is easy, particularly for those without first-hand knowledge of the situation; but I think that any person with experience of conditions and prejudices in Southern Africa and an understanding of the dangers implicit in the racial situation, will give the Federal Government credit for a real desire to implement the racial partnership envisaged when the Federation was founded, and for proceeding with courage and determination and as much speed as in the circumstances has been practical.

It is particularly encouraging that Europeans in Rhodesia are not allowing the violence and folly that have been manifested in Nyasaland to destroy their faith in the possibility of inter-racial co-operation or weaken their determination to do their part in securing it. What has happened has, at least to my mind, made it clear that when the time comes to make changes in the present constitution, it will be essential to devise safeguards to ensure that neither the present European majority nor a possible future African majority would be able to enact unfair legislation on racial grounds. It is this understandable mutual fear which constitutes the chief bar to the confident and fruitful co-operation of the races that all reasonable people want to see.

Problem in the Union

As compared with the Federation, the Union has the advantage of a much larger European population. The Union, unlike the Federation, is making no serious effort to strengthen its European population by immigration, but in spite of that even the most fervent African nationalist knows that the Union cannot be turned into an exclusively African country. Indeed, in the Union all thinking Africans and Europeans know very well that the question that must be answered is not whether South Africa should be a multi-racial state, but rather how such a state should conduct its affairs.

In these circumstances, it ought to be easier in the Union than elsewhere to find the way to inter-racial co-operation. Nor should a justified concern at certain unfortunate aspects of race relations in the Union be allowed to blind us to the fact that considerable progress has been made. The economic expansion of the country has benefited all races, and the standard of living of Africans, which is still far too low, has risen rapidly—indeed, more rapidly than that of the Europeans. It seems to me that too little recognition is given to this improvement in the material well-being of all races which has taken place since the end of the war, and to the significant changes in thinking of a large cross-section of the public of the Union during the past year.

Most Europeans in South Africa now realize that in due course the Africans must obtain a share in the government of the country. The differences between parties do not turn on whether or not Africans should have greater civic rights but on whether reasonable African aspirations can or should be satisfied by the grant of autonomy in their tribal areas, or whether, on the other hand, they must receive a share in the central government of a united country. The Government has emphasized its desire to develop the tribal areas to the full—economically, socially, and politically. This, in itself, is highly desirable. It is important that it should be clearly understood, both by its opponents and its followers, that the Government's policy of *apartheid* has a positive as well as a negative aspect.

On the economic side, the idea that the tribal areas should be developed in separation from the rest of the country is, I am sure, both impractical and dangerous, but the fact remains that the economic development of the reserves has lagged far behind and needs to be energetically tackled.

On the political side, it may perhaps seem strange, after what has happened in the North, that the South African Government should deliberately set about creating autonomous African territories whose relationship to the rest of the Union would seem in many ways analogous to the relationship of Nyasaland to the rest of the Federation. Nevertheless, I am convinced that the policy of building up machinery of local self-government in the tribal areas is wise.

Obviously, however, it is only a beginning. There has been some talk of eventual full independence for the African areas, but I do not believe that South Africans of any race or party would seriously contemplate the partition of the country. And it is surely plain that autonomous African territories will never accept membership with Europeans in one political system unless they can at least look forward to a fair share in the central government of the whole system. The development of local self-government for Africans in the tribal areas, and the granting to Africans of a part in the central government, are not opposed but complementary conceptions.

Then it must be remembered that the policy of local African autonomy leaves untouched the question of the political future of the millions of Africans who do not live, and never will be able to live, in the tribal areas.

Constitutional Changes

It seems to me that, from whatever angle one approaches this complicated problem, one comes back to the conclusion, just as much in the Union as in the Federation, that constitutional changes are essential by which both Europeans and Africans would be guaranteed against the passing of unfair discriminatory legislation based on race. Once it has been admitted, as it has been

by thinking people of all parties, that Africans must be allowed and encouraged to develop economically, culturally, and politically, to the full extent of their capabilities, no other conclusion is possible. It seems to me that there is much more unity on this matter among South Africans than appears on the surface, and it may be that a satisfactory way of co-operation between Europeans and Africans in those countries which are and must remain the permanent home of both races, will be found sooner than is often supposed.

It is no good glossing over the fact that both the Union and the Federation face difficult and dangerous problems. Nevertheless, we retain full confidence in their future. Both have great economic potentials and both require a high rate of investment to create the material conditions in which their human problems can be solved. Our Corporation is favourably placed to help provide the risk capital and the technical and administrative skills that are needed. The Union and the Federation have an inspiring task before them, and the Anglo American Corporation, in its sphere, can play an essential part in tackling it.

Looking back on 1958, it is possible to detect a significant and widespread revival of interest in investment in the gold mining industry. This is striking in view of the slowing down in other sectors of the economy. This interest appears to be continuing in spite of the political uncertainties I have mentioned. The loan of £4,262,000 by the Deutsche Bank to the Corporation, and the formation of the American-South African Investment Company, to acquire shares in South African companies, are symptoms of this revival of interest; its yardstick is the considerable advance in the prices of most shares in South African mining and mining-finance companies on the stock markets.

The year 1958 was a record one for production and profits by the South African gold and uranium industry, and it was a notable year for new business in this sphere. From this point of view, Western Deep Levels takes pride of place. This company's mine, which lies to the south of Blyvooruitzicht and West Driefontein, will be of exceptional size and opening it up will require an investment of nearly £30,000,000, or more than twice what is normally required for the development of a large mine. A relatively high grade of ore is expected and operations are planned on a very large scale. For these reasons we are confident that this great enterprise will be a highly satisfactory and profitable one for the Corporation.

The picture of the Orange Free State goldfield is a most encouraging one, and we are beginning to earn increasing benefits from our large investment there. Although no new mines are at present being opened up by us in that field, there is a great deal of new development taking place on our established properties, aimed at increasing their capacity and realizing their potential to the full.

Copper and Diamonds

The copper mining industry started the year under very difficult conditions. The price of copper fell to as low as £160 a ton in February, 1958, and all the major producers were faced with the necessity for reducing production to correct the condition of over-supply and to restore stability to the market. Fortunately, during the year the position of the copper industry improved substantially, and in October copper reached a price of £240 a ton.

The diamond industry, like the copper industry, started the year 1958 in unfavourable circumstances, but here again, I am glad to say, a marked improvement occurred during the year.

At present, the demand for diamonds, both gem stones and industrials, is satisfactory. Fundamentally, however, the market for gems is in a sounder position than that for industrials: the demand for industrials being influenced to a considerable extent by renewed stockpiling by the United States Government. There are, however, we believe, considerable opportunities for increasing the use of diamonds in industry in their present applications, and also for finding new fields for their use. Much work is being done in this direction. We may confidently expect that the year 1959 will be a sound one for diamonds and that our revenue from this source will not be less than it was in 1958.

All in all, 1958 was a most successful year for the Corporation. Mainly as a result of an improvement in income from investments, the profit for the year increased by just over £1 million. Because of the larger number of shares in issue, unchanged dividends for the year on the Ordinary shares of 8s. per share cost nearly £250,000 more than the Ordinary dividends paid for 1957. The appropriation to general reserve amounted to £1,500,000, which is £500,000 more than last year, and the general reserve now stands at £24,500,000. There has been an increase in the unappropriated balance of over £175,000. By the end of the year the book cost of quoted investments had increased by nearly £2,670,000 and the market value of these investments by about £17,740,000.

Company News

As from Monday, June 1, 1959, the offices of Dorr-Oliver Co Ltd, at present at Abford House, Wilton Road, S.W.1, and the Mechanical Engineering Division at 21-22 Manor Mount, Forest Hill, S.E.23, will move to Norfolk House, Wellesley Road, Croydon, Surrey. Telephone: Municipal 2488 (10 lines). Telegrams: Dorroliver-Croydon.

★

What is probably the largest exhibition ever to be staged by a single company in the Cutler's Hall, Sheffield, will be opened on Monday, June 1, by the Master Cutler. Staged by the Mond Nickel Co., the exhibition, which will be open from June 2 - 5, has been designed to demonstrate the properties of nickel, nickel-containing materials, the platinum metals, spheroidal graphite cast iron to engineers, technologists and students. The exhibition will cover the range of the company's products and show, by means of exhibits, illustrations, specimen materials and publications, the special properties which make these products vital materials for many applications.

"PROTO" No. 2 Mark IV, 2-hour self-contained breathing apparatus sets, unused, brand new condition, complete with instruction booklet, packed in strong pressed steel carrying cases; recent Ministry release, offered at special bargain price of £25 10s. each. Woodfield and Turner Ltd., Cannon Street, Burnley. Telephone 78134.

MINING FINANCE—*Continued*

of such a development would not be so great as in the case of such mines as Durban Deep, the gold section profit might easily be multiplied by the order of eight or ten, while costs on the uranium section would also benefit substantially. An investor in West Rand Consolidated is paying nothing for this gamble.

CENTRAL PROVINCES MANGANESE

The effects of the recession in the United States steel industry are strongly marked in the 1958 profit and loss account of Central Provinces Manganese Ore. Consumer de-stocking and the resultant fall in ore prices resulted in the trading balance being almost halved at £1,601,953 against £3,046,635 (after transferring £200,000 to stock reserve) for 1957. Taxation fell more or less proportionately, so that the net profit after taxation came out at £511,357 against £1,010,345. The effect of this on distributions was a reduction in the bonus from 1s. 4d. per share to 4d., the actual dividend remaining unchanged at 2s. 10d. for the year.

Unfortunately, the immediate future for Indian manganese, and therefore C.P.M.O.'s earnings, remains cloudy. The fact that market quotations for manganese have remained nominal for so long implies either that stocks before the recession were far too high or that manganese is still in over-supply. Neither view would suggest a quick ending to the difficulties.

NEW RECORDS AT MOUNT ISA

Mount Isa Mines broke four production records in the four weeks to May 3. More than 197,600 tons of lead and copper ore were treated during the period, making an average of 7,060 tons daily. From the 137,474 tons of copper ore included in this total, 4,165 tons of blister copper were recovered.

The only sectors of operations not to reach new peaks were lead ore production, which fell to 60,202 tons, and zinc production at 1,806 tons of concentrate.

The new records are a measure of the success Mount Isa is achieving in its £A20,000,000 expansion scheme. When the programme is completed in 1963, Mount Isa will be treating 13,000 tons of ore daily, but output at the moment is limited to 8,000 tons per day because of a shortage of capacity on the Townsville Railway.

St. John d'El Rey Reduce Loss.—Consolidated loss of St. John d'El Rey for the year ended December 31 amounted to £221,650 after special charges of £217,366 compared with £521,379 after special charges of £15,060. No dividends are recommended (same).

MINING GEOLOGIST

Minimum five years' experience in pre-Cambrian areas, required for 18 months in Portuguese Angola. Geophysical experience desirable. Send résumé in confidence to Box No. 636, *The Mining Journal Ltd.*, 15 Wilson Street, Moorgate, London, E.C.2.

ASSISTANT METALLURGIST
Required in the Consulting Engineer's Dept. of a City mining finance house. Salary according to age and experience. Five-day week. Staff luncheon Club. Pension scheme. Write giving full particulars to Box No. 2568, c/o Charles Barker & Sons Ltd., Gateway House, London, E.C.4.

The Proprietors of British Patent No. 698,978 for "METHOD AND APPARATUS FOR THE CONSTRUCTION OF BORE-HOLES AND SHAFTS OF EVERY DESCRIPTION IN MINING INSTALLATIONS" desire to enter into negotiations with a firm or firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2.

SOUTHERN RHODESIA GOVERNMENT

VACANCY:

ASSISTANT GOVERNMENT METALLURGIST
DIVISION OF TREASURY AND MINES

Applications are invited for the post of Assistant Government Metallurgist, Department of Mines, Southern Rhodesia.

The minimum qualifications are a degree or diploma in metallurgy from a recognized University or School of Mines, followed by at least seven years' practical experience after graduation.

The work of the Metallurgical Laboratory is essentially the testing of ores and minerals, with the practical application of beneficiation for the extraction of precious and base metals and minerals.

It is hoped to expand the laboratory to cover ceramics and industrial metallurgy, and experience in these would be a recommendation.

Salary Scale: £1,925 x £75 - £2,000 x £50 - £2,050 p.a.

The successful applicant will, subject to efficiency, be eligible in due course for promotion to the post of Government Metallurgist, which has a fixed salary of £2,350 per annum.

The successful applicant will also receive full passage expenses to Rhodesia together with half travelling expenses for wife and dependent children.

Applications giving particulars of qualifications, experience, age, marital status, and date available to commence duty, should be made to the Chief Government Mining Engineer, P.O. Box 8009, Causeway, Southern Rhodesia, from whom further details regarding conditions of service may be obtained.

ARISTON GOLD MINES

NEW SHARE ISSUE

MR. C. J. BURNS' SPEECH

The 29th annual general meeting of Ariston Gold Mines (1929) Ltd. was held on May 22 in London.

Mr. C. J. Burns, chairman, said:

I would refer you to the Remarks in my Statement accompanying the Report and Accounts, outlining the proposals for the issue of further capital.

The Board has had no doubt for some time past of the necessity for the raising of further money, and the only question has been when would be the most appropriate time for such an operation.

Having regard to current market conditions and prospects, and following a visit I paid last week to Ghana, when I had the privilege of discussions with Cabinet Ministers and Members of the Government there, it has been decided that the issue should be made forthwith. In consequence, all Stockholders registered on June 3, 1959, will receive on or about July 10 next a Provisional Allotment Letter representing 1 share for every 7 shares held by them on June 3, 1959, and which are being issued at 3s. 3d. per share, payable in full on acceptance. Acceptances will be received up to August 7, 1959, which date has been fixed, having in mind the Stockholders who are resident abroad, and to ensure preservation of their rights so far as is possible.

When the Issue is completed, the Company would receive an amount of £208,929 gross, and the Issued Capital of the Company would be increased by £160,714 to £1,285,714. On the increased capital, the Board feel confident that, in the ordinary course, a Dividend of not less than 20% gross will be paid, which on the basis of the net profit figures of 1958 would be covered 1¼ times. Assuming a dividend of not less than 20%, the yield on the new capital at the issue price of 3s. 3d. per share would be approximately 15%.

Deep Level Development

As mentioned in my Statement, the main purpose of raising the new capital will represent the expenditure on the major shaft sinking and deep level development programme now being vigorously pursued. This programme will ensure the continuity of the ore reserves position (which is about five years ahead of the Mill), and which will not only preserve the stability of future output, but will provide that flexibility which is so essential for the most economic working of the Mine.

In that connection, during my perforce all too brief visit to Ghana last week, I had comprehensive discussions with our General Manager, Mr. F. Clelland, and he assured me that the development on the lowest levels of the Mine is proceeding well up to schedule, and is looking most satisfactory.

We all realize that the present fundamental mining and development operations must be primarily concerned with the main ore bodies at depth, but it was most pleasing to hear from Mr. Clelland his conviction that the disclosure of a new rich lens on the 13th Level in the North Orebody augurs well for the future of the new section of the Mine. So far, the length exposed is 344 feet at an average value of 6.6 dwt. over 131 inches, and driving is continuing.

Additionally, the rich zone being explored near the surface on the 3rd, 5th and 6th Levels between our main orebodies and the northern limits of the Ghana Main Reef Company's reefs gives encouragement as an indication of, first, an available store of richer ore (limited in tonnage though it may be until it is fully developed), and secondly, an indication that more extensive development in this area is warranted. In that connection, it could be visualized that if the area opened out into major ore bodies, then your Company would proceed with the full opening up and development of this area.

I need hardly say that whenever we have any further news as to these important developments this will be immediately conveyed to Stockholders, apart from the usual information covering the actual conduct of operations reported in the customary monthly and quarterly progress Reports.

Ghana Government's Appreciation

In the course of my discussions with the Ghana Ministers the opportunity was taken to review the position of the gold mining industry in that country. These discussions to my mind only serve to confirm the views which I have already expressed in my Chairman's Review of this Company and also remarks that I have passed in associated Companies.

The Ghana Government are appreciative of the work that has been done by Ariston Gold Mines and the contribution they have made towards the prosperity of their country, and they have no intention of making that task more difficult. A number of suggestions were made by me to the Government this time and I hope shortly to be in a position to announce further progress in the policy of full co-operation now existing.

The report and accounts were adopted.

SOUTH CROFTY, LTD.

The fifty-third Annual General Meeting was held on May 21 at Redruth.

Mr. T. Pryor, D.S.O., M.I.M.M., Chairman, presided, and the following is an extract from his circulated Statement:

At South Crofty during the year to December 31, 1958, 75,596 tons were treated, producing 741¾ tons of black tin, an increase of 4,963 tons treated and 16¼ tons of black tin produced. The average price for tin metal received was £717 per ton, as compared with £725 in 1957 and £760 in 1956. The gross receipts from mineral sales were £366,674, an increase of £8,627 over the previous year, but the increase in revenue was more than offset by increased working expenditure caused by the greater tonnage of ore mined and treated, and by substantial increases in development work. The gross expenditure on development underground was £74,721. The Profit and Loss Account shows a loss of £51,575, which is an increase of £29,572 over the loss of the previous year. It was not until almost the end of the year that the new treatment plant was able to bring the amount of ore that could be treated to 8,000 tons per month and so increase earnings. Meanwhile the underground labour force had to be kept on development work in excess of immediate requirements until it could be transferred to the deepening of New Cook's Kitchen Shaft.

The exploratory development of the year has given satisfactory results. It has confirmed that important orebodies exist in the new northern lodes, and on Nos. 3A and 3B lodes a wide orebody is in course of exploration with good results. As from the beginning of 1959 the mine has been working at a profit.

WEST RAND CONSOLIDATED MINES, LIMITED

(Incorporated in the Union of South Africa)

REVIEW OF OPERATIONS DURING THE YEAR ENDED DECEMBER 31, 1958

CHAIRMAN'S STATEMENT

The following is a Statement dated March 25, 1959, made to members by the Chairman, **Sir George W. Albu, Bart.**, on the Directors' Report and Accounts for the year ended December 31, 1958:

"As it has become almost universal practice for Chairmen of Companies to issue their statements to shareholders prior to Annual General Meetings, this statement is attached to the Reports and Accounts for the year ended December 31, 1958.

These indicate clearly the results of operations at the mine during 1958 and the position of the Company at the end of that year. It will be seen that operations followed the pattern established in recent years of profits, before tax, in the order of two and three-quarter million pounds. The dividend distribution of 4s. 3d. per Ordinary share, first attained in 1957, was repeated.

In April, 1958, representatives of the Combined Development Agency visited the Union in order to discuss with the Atomic Energy Board future purchases of uranium oxide under the existing arrangements. At these discussions it was agreed that the quantity of uranium oxide to be purchased by the Agency would be limited from July 1, 1958, and consequently a quota system for the producers was introduced by the Atomic Energy Board. Any excess production may be disposed of on behalf of producers by that Board without reference to the Agency. This Company was not materially affected by the new arrangements.

Shareholders are aware that the Company's contract terminates on December 31, 1964, but I would point out that because of the high uranium content of the Bird Reefs on its property, it is well placed to compete in the uranium market after the expiry of its contract. By way of contrast, however, it is to be noted that, under existing conditions, the gold section of the mine, with an average recovery of under 3 dwt. per ton milled, can at best only be operated at a very marginal rate of profit. Since 1950, when the last increase in the price of gold became effective, working costs in this section have increased from 24s. 7d. to 35s. 9d. per ton milled. It will be apparent, therefore, that the demand for uranium came at a most propitious time.

Recently the Atomic Energy Board authorized the publication of additional information on uranium sales from January 1, 1958, and this is reflected in the Reports and Accounts submitted. The price received for uranium sold during the financial year averaged 73s. 1d. per lb. and the working profit from this source increased by £45,600.

Revenue from all sources amounted to £7,941,176, which, however, included uranium royalties in respect of the years 1952 to 1957 due to the Company as the owner of the mineral rights over portion of its mining area. Working expenditure and other costs for the year amounted to £5,140,344. These revenue and cost figures, however, are not comparable with those of previous years, as for the first time direct uranium recovery costs have been included in working costs and not deducted from revenue as in the past. The total profit earned before taxation, therefore, amounted to £2,800,832, being the highest recorded in the long history of the Company.

The development footage accomplished during the year at 101,568 feet was 10,711 feet less than during the previous year, the major portion of the de-

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT

GEOPHYSICISTS CHEMISTS GEOLOGISTS
MINERAL ECONOMISTS PETROLEUM TECHNOLOGISTS

are urgently required for work of national importance with the Bureau of Mineral Resources, Geology and Geophysics, throughout Australia and its Territories.

The Bureau of Mineral Resources is engaged in:

(i) prospecting by seismic, gravity, electrical, magnetic and other geophysical methods for mineral deposits, including uranium, oil, coal, etc., and related laboratory investigations; operating magnetic, seismic and ionospheric observatories. Airborne magnetometer and scintillometer surveys form an important part of the Bureau's operations;
(ii) detailed and regional geological mapping; prospecting for mineral deposits, including uranium, oil, coal, underground water, etc., engineering geology, and laboratory investigations;
(iii) investigations concerning oilfield exploration and exploitation.

Appointment:
GEOPHYSICIST GRADE 3
GEOLOGIST GRADE 3
PETROLEUM TECHNOLOGIST GRADE 3
Salary Range (Aust.): £1,506 - £1,686
GEOPHYSICIST GRADE 2
GEOLOGIST GRADE 2
CHEMIST GRADE 2
Salary Range (Aust.): £1,416 - £1,506
GEOPHYSICIST GRADE 1
CHEMIST GRADE 1
MINERAL ECONOMIST GRADE 1
GEOLOGIST GRADE 1
Salary Range (Aust.): £996 - £1,416
(Honours Graduates commence £1,191)

Grade of position and commencing salary will be determined upon the applicant's qualifications and experience. Travelling or camping allowances are payable when on duty away from headquarters. District allowances up to £275 per annum are payable in certain areas of Australia. An allowance in lieu of overtime is payable while engaged on field duties. Geophysicists engaged on flying duties receive an additional allowance of 2s. 6d. per hour.

Minimum academic qualifications are:

(i) *Geophysicist*: A University degree, preferably with honours or its equivalent, with a major (three-year) pass in Geophysics, Physics, Geology, Mathematics, or other appropriate subject (e.g. Electronics, Electrical, Radio, or Mining Engineering); Physics and Mathematics to second-year standard, and for certain positions Geology to first-year standard; or such other qualifications and experience as are considered suitable.
(ii) *Chemist*: A University degree, preferably with honours or its equivalent, with a major (three-year) pass in Chemistry; or such other qualifications and experience as are considered suitable.
(iii) *Geologist*: A University degree, preferably with honours or its equivalent, with all the subjects of Geology at third-year standard; or such other qualifications and experience as are considered suitable.
(iv) *Mineral Economist*: A University degree, preferably with honours or its equivalent in Science or Engineering (Mining or Metallurgy). Training in Economics an advantage.
(v) *Petroleum Technologist*: A University degree, preferably with honours or its equivalent, with a major (three-year) pass in Chemistry or Geology; Chemistry and Geology to second-year standard; or such other qualifications and experience as are considered suitable.

Applicants should state full name, date and place of birth, brief details of education and subjects taken for their degree, and indicate the type of position preferred. Copies only of references, testimonials, or certificates should be forwarded.

The Headquarters of the Geophysical Section are Melbourne, the remaining Sections are located at Canberra. Some positions have headquarters at Darwin or Port Moresby.

Applicants appointed to positions with present headquarters Melbourne will be required to transfer to Canberra at a later date.

Salary will be paid to successful applicants from the date of embarkation at United Kingdom (or other overseas) port. Fares of successful applicants and those of their families (if any) will also be paid subject to the applicant completing an appropriate bond of service.

Applications, which close on June 15, 1959, should be forwarded to:

The Official Secretary,
Australia House, The Strand,
LONDON, W.C.2.

crease arising in the gold section, where the footage was 10,558 feet less than for 1957. Of the footage sampled in the gold section, 12,965 feet, or 73.4 per cent was payable, with an average value of 8.5 dwt. over 42 inches, whilst in the uranium section 79.3 per cent, or 21,595 feet, was payable with average values of 1.9 dwt. gold and 50.9 oz. (3.181 lb.) uranium respectively.

There was a satisfactory supply of Native labour throughout the year, the seasonal decline in the later months being less noticeable than usual.

Operations for the current year have progressed normally, and as the Report for the quarter ending March 31, 1959, will have been issued prior to the dispatch of this review, no useful purpose will be served by quoting herein the results for January and February.

The arrangements with the Electrolytic Metal Corporation (Pty.), Limited, referred to in the Directors' Report, were recently completed, and your Company's participation in this venture will be by way of a 20 per cent shareholding in that company, coupled with an obligation to make certain advances to it. Plans for the erection of the permanent plant have been completed by that company, and orders placed for the major items of machinery and equipment.

This concludes my review of the Company's operations for the year 1958. Before closing I wish to express the Board's appreciation of the loyal and efficient services rendered by Mr. E. M. Stewart, the General Manager and his staff at the mine, as well as by the Technical and Secretarial staffs at Head Office."

At the Annual General Meeting of members of the Company held in Johannesburg on May 12, 1959, the Chairman of the Company stated:

"The levy payable by mines of Group A for the financial year of the Pneumoconiosis Board ending March 31, 1960, has been fixed at £800,000, being one-third only of the amount levied in respect of the previous financial year, due mainly to a decrease in the number of new cases of pneumoconiosis and tuberculosis amongst mine employees. A recent valuation of the Controlled Mines Compensation Fund has disclosed a surplus in the Fund in respect of Group A mines, and this surplus is required by the Act to be set off against any levy imposed on such mines. The Pneumoconiosis Board has decided to set off against the aforementioned levy an amount of £800,000 of the surplus in the Compensation Fund. This mine is included in Group A and consequently no levy will be payable in respect of the period April, 1959, to March, 1960.

In my review for the past year I mentioned that the price received for uranium sold during 1958 averaged 73s. 1d. per lb. After deducting gold and sundry revenue from the expenditure incurred in the Uranium Section, the cost of production per lb. of uranium sold was 31s. 8d., giving a profit of 41s. 5d. per lb.

I would also like to refer to the sampling results in the uranium section, which were quoted as 1.9 dwt. gold and 50.9 oz. (3.181 lb.) uranium, without reference being made to the channel width of 21.5 inches. These figures, when related to the stoping width of 34 inches, are reduced to 1.2 dwt. gold and 32.2 oz. (2.01 lb.) uranium, and in conformity with usual practice are subject to any reduction which may be considered necessary when compiling the ore reserve."

I.M.E. Symposium

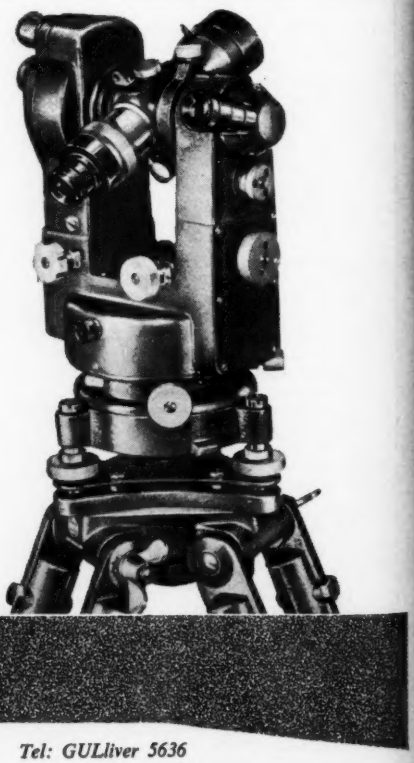
Introductory notes concerning the Symposium on Shaft Sinking and Tunnelling, arranged by the Institution of Mining Engineers, appeared in our issue of December 12, 1958.

The programme of technical sessions at the Symposium is as follows:

Wednesday, July 15. Opening session, 9.30 a.m.: chairman, Mr. T. A. Rogers, president, I.M.E.; opening address by Sir James Bowman. Session 1, 9.45 a.m.: Shaft sinking; chairman, Prof. J. C. Mitcheson; papers 15 and 13. Session 2, 11.10 a.m.: Tunnelling; chairman, Mr. H. J. Widdowson; papers 1 and 5. Session 3, 2.30 p.m.: Shaft sinking; chairman, Mr. J. C. Fletcher; papers 17 and 6. Session 4, 4.30 p.m.: Tunnelling; chairman, Dr. W. Reid papers 22, 9, 23.

Thursday, July 16. Session 5, 9.30 a.m.: Shaft sinking; chairman, Mr. H. J. Atkinson; papers 8 and 2. Session 6, 11.15 a.m.: Tunnelling; chairman, Mr. H. R. King; papers 18, 7. Session 7, 2.15 p.m.: Shaft sinking; chairman, Mr. E. H. Browne; papers 4, 16. Session 8, 4.05 p.m.: Tunnelling; chairman, Mr. R. S. McLaren; papers 3, 10. At 7.15 p.m.: Symposium dinner, Grosvenor House.

Friday, July 17. Session 9, 9.30 a.m.: Shaft sinking; chairman, Dr. H. L. Willett; papers 14, 24, 12. Session 10, 11.10 a.m.: Tunnelling; chairman, Mr. D. Douglas; papers 11, 19. Session 11, 2.15 p.m.: Shaft sinking; chairman, president of North Staffs. Institute of Ming. Eng.; papers 20, 21, 25. Closing session, 3.45 p.m.: chairman, Mr. T. A. Rogers; summary by Mr. H. E. Collins and closing address by Mr. T. A. Rogers.



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